ASERS

Journal of Environmental Management and Tourism

Quarterly
Volume XII
Issue 4(52)
Summer 2021
ISSN 2068 – 7729
Journal DOI
https://doi.org/10.14505/jemt

ASERS Publishing

Summer 2021
Volume XII
Issue 4(52)

ASERS Publishing
http://www.asers.eu/asers-publishing
ISSN 2068 – 7729
Journal DOI: https://doi.org/10.14505/jemt

Table of Contents:

Summer 2021
Volume XII
Issue 4(52)

ASERS Publishing
http://www.asers.eu/asers-publishing
ISSN 2068 – 7729
Journal DOI: https://doi.org/10.14505/jemt

Call for Papers
Fall Issues 2021
Journal of Environmental Management and Tourism

Journal of Environmental Management and Tourism is an interdisciplinary research journal, aimed to publish articles and original research papers that should contribute to the development of both experimental and theoretical nature in the field of Environmental Management and Tourism Sciences.

Journal will publish original research and seeks to cover a wide range of topicsregarding environmental management and engineering, environmental management and health, environmental chemistry, environmental protection technologies (water, air, soil), pollution reduction at source and waste minimization, energy and environment, modeling, simulation and optimization for environmental protection; environmental biotechnology, environmental education and sustainable development, environmental strategies and policies, etc. This topic may include the fields indicated above, but are not limited to these.

Authors are encouraged to submit high quality, original works that discuss the latest developments in environmental management research and application with the certain scope to share experiences and research findings and to stimulate more ideas and useful insights regarding current best-practices and future directions in environmental management.

Journal of Environmental Management and Tourism is indexed in SCOPUS, RePEC, CEEOL, ProQuest, EBSCO and Cabell Directory databases.

All the papers will be first considered by the Editors for general relevance, originality and significance. If accepted for review, papers will then be subject to double blind peer review.

Deadline for submission:	20th of August 2021
Expected publication date:	September 2021
Website:	https://journals.aserspublishing.eu/jemt
E-mail:	jemt@aserspublishing.eu

To prepare your paper for submission, please see full author guidelines in the following file: JEMT_Full_Paper_Template.docx, then send it via email at jemt@aserspublishing.eu.

DOI: https://doi.org/10.14505/jemt.v12.4(52).26

Tourism Supply Efficiency: An Analysis of Countries in the Asia-Pacific Region

Sakkarin NONTHAPOT
Indo-China Country International Trade and Economic Research Sector
Faculty of Interdisciplinary Studies, Khon Kaen University, Thailand
sakkno@kku.ac.th

Suggested Citation:

Nonthapot, S. (2021). Tourism Supply Efficiency: An Analysis of Countries in the Asia-Pacific Region. *Journal of Environmental Management and Tourism*, (Volume XII, Summer), 4(52): 1139 - 1149. DOI:10.14505/jemt.v12.4(52).26

Article's History:

Received 4th of April 2021; Received in revised form 20th of April 2021; Accepted 7th of May 2021; Published 21st of June 2021.

Abstract:

The objective of this research is to analyze the factors affecting the tourism supply and its efficiency of the tourism supply for countries in the Asia-Pacific region. The method uses the stochastic frontier with Maximum Likelihood Estimation (MLE) analyzed by Frontier software. 4.1. The data were collected from panel data from 2010 - 2019 for 23 countries. The results of the study revealed that 1) Tourism investment from the private sector and timing factors positively affect the tourism supply of countries in the Asia-Pacific region, while the tourism labor value factor has a negative effect on the tourism supply of countries in the region 2) For the technical performance measurement of tourism supply in each sub-region in the Asia-Pacific region, the average is between 0.387 and 0.657. East Asia shows the highest technical efficiency in China, Hong Kong, Japan, Macau and Mongolia while South Asia has the lowest technical efficiency in Bangladesh, India, Nepal, Pakistan, Sri Lanka and the Maldives, respectively.

Keywords: tourism supply; tourism efficiency; regional tourism; stochastic frontier.

JEL Classification: Z32; F20; R11.

Introduction

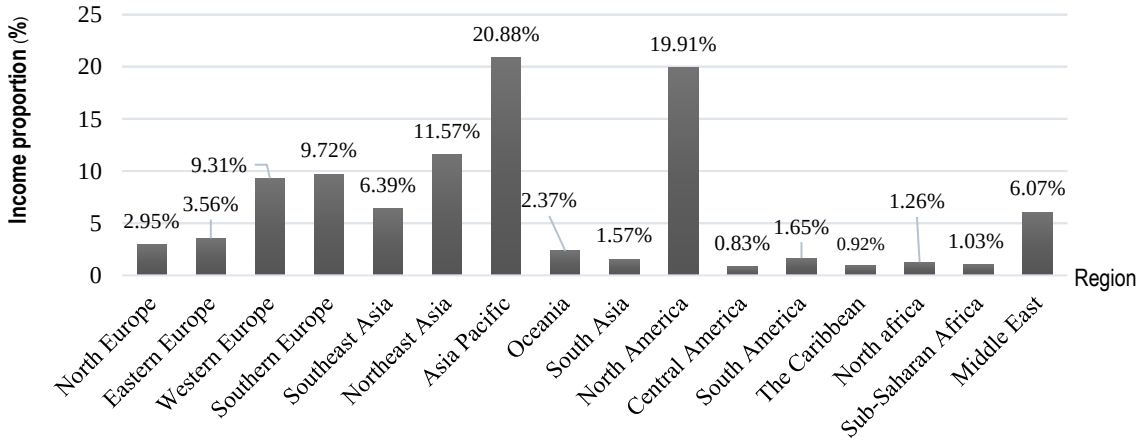
The global tourism industry has greatly increased in value thereby creating revenue for countries in different regions across the world. The total number of tourists rose to 1.4 billion in 2018 (World Tourism Organization 2020). The key global tourism markets include the Asia Pacific market, the African market, the European market, etc. As a result of growing tourism, each country in every region has given priority to tourism, especially in the Asia Pacific region.

When considering the key global tourism markets, Asia Pacific is one of the regions with high levels of tourism efficiency. Specifically, it is the largest tourism market in the world, with increasing revenue (Figure 1). The tourism market in Asia Pacific represents 20.88% of the total revenue from all regions. It has the largest proportion when compared with other regions in the world. That is because most Asia Pacific countries have extensive coastal areas and islands. There are 23 countries altogether in the region with a diversity of tourism resources, i.e., natural, historical and cultural attractions. Thus, it draws the attention of tourists from all over the world to visit this region. For this reason, the World Travel & Tourism Council: WTTC (2020a) reported that during 2016 – 2026 tourism GDP is expected to keep growing at 4% per year. It is expected that by 2026, tourism will bring higher employment across the world, representing 1 in 9 of all job positions. The Asia Pacific market has increased in the same way. Technology also plays a role in supporting tourism supply, *e.g.,* smartphone booking and peer-to-peer booking; and has become a major factor affecting the tourism business (Amponpan 2015).

Tourism growth in Asia Pacific has increased continually. According to the report of The World Bank (2020b), the value was 595.49 billion USD in 2013. Since then, it continued to rise to757.73 billion USD (in 2017). Furthermore, the World Travel & Tourism Councilexpects that the tourism market will increase in value to 982.32

billion dollars per annum during 2018–2022 (World Travel & Tourism Council 2020b). Although the world is currently experiencing a downturn, it is expected that the number of foreign tourists in Asia Pacific will increase continually. This reflects the efficiency of regional tourism supply that can draw more and more foreign tourists, resulting in an increase in the region's tourism market (Nonthapot 2020). However, the using of stochastic frontier analysis (SFA) has not yet been employed in studies on tourism efficiency in Asia Pacific as a region.

Figure 1. Proportion income of international tourists visiting countries in the Asia-Pacific region 2017

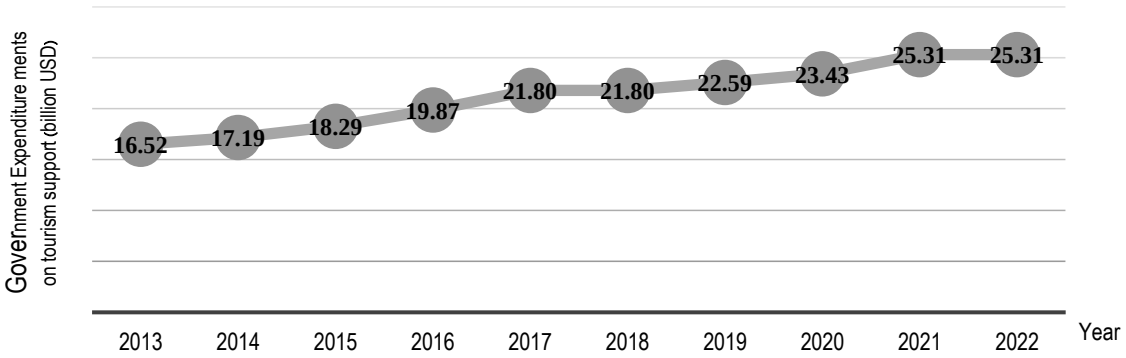


Source: The World Bank (2020a)

Revenue resulting from the increasing number of tourists has risen continuously as reported by the World Bank (2020). The revenue in 2017 increased from 2007 by 588,495 million USD in Asia Pacific. However, the proportion of revenue varies according to the number of tourists in Asia Pacific. This indicates the rapid increase in the size of the tourism market, which affects economic growth in each Asia Pacific country.

The increase in the number of tourists and revenue leads to the increase in the size of the tourism industry in Asia Pacific. Consequently, the government in each area gives a high priority to tourism. This can be noticed in 2013-2017, where government expenditureon tourism support increased by 20.99billion USD (Figure2). In addition, the World Travel & Tourism Council (2020c) predicted that expenditure will increase even more to 25.31billion USD by 2022. This reflects the support that tourism has received.

Figure 2. Government expenditure on tourism support (billion USD) during 2013 – 2022



Source: World Travel & Tourism Council (2020c)

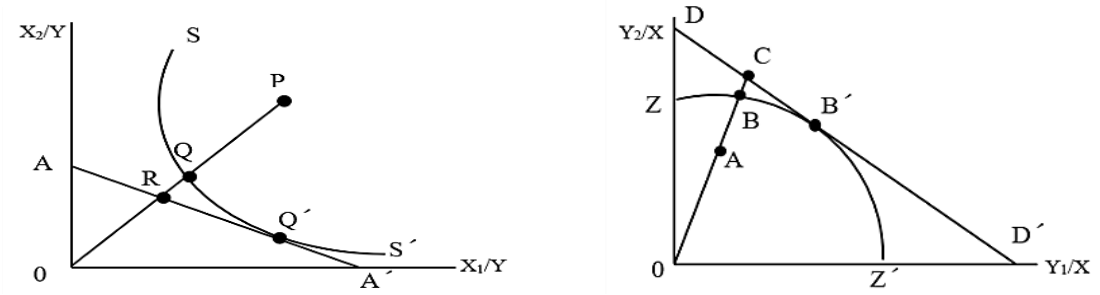
The tourism industry is affected by economic development based on tourism demand. In particular, the government and private sectors in each country provide high tourism budgets in Asia Pacific and capital investment in tourism by the private sector is likely to continue driving tourism supply. This indicates that supply developmentplays a vital role in tourism (Nonthapot, Lean 2015). Anumat (2013) also found that production equation models describe the factors influencing the efficiency of tourism supply in Malaysia, Thailand, and Singapore. The Stochastic frontieranalysis (SFA) was used for estimation. It can be assumed that this concept can be applied to tourism supply.

According to the data presented above, the tourism market in Asia Pacific has experienced increasing revenue based on the number of tourists. There were 342 million tourists in Asia Pacific in 2018 (The World Bank 2020a), with resulting revenue distribution from the continued increase in the number of foreign tourists in Asia Pacific. The government in each country gives high priority to tourism supply support, which might affect the efficiency of tourism supply. Hence, a study on the factors affecting tourism supply should be conducted, together with the measurement of the efficiency of the tourism supply in Asia Pacific to obtain primary data to enhance tourism supply in order to maximize its benefits, which will finally lead to tourism industry development in every Asia Pacific country. Moreover, the primary data will be used to support planning for decision making and guidelines for investment by the government and private sectors.

1. Literature Review

Technical efficiency is divided into two approaches. The calculation of technical efficiency is based on input and output. For the output, the aim is to maximize the output of production while production inputs are minimized (Debreu 1951; Koopmans 1951). Figure 3 presents the efficiency from the input to output that assumes that the firm produces inputs X1 and X2, Y is the output for an efficient firm. The SS is an isoquant line that represents the firm of production and the AA line represents the price/input. The production process is represented by the OP line. The points between Q and P are the number of inputs which can be reduced without reducing output. The point RQ is the reduced production cost. It will be determined when the company efficiently operates in terms of allocation at point Q. Therefore, the allocative efficiency is represented by 0Q and 0R. And, the combination of the two types of efficiency is Total Efficiency, which is represented by 0R/0P.

Figure 3. Technical and allocative efficiency



(a) efficiency of input (b) efficiency of output

The SFA technique has had limited use in studies on the efficiency of tourism supply. Anumat (2013) studied the measurement of the efficiency of tourism supply in Malaysia, Thailand, and Singapore. The findings revealed that the following factors generated higher revenue in the tourism industry, leading to national economic growth: (1) changes in the production volume of passengers; (2) changes in government expenditure on transportation and communication; (3) changes in the percentage of population with access to sanitary facilities; and (4) changes in the budget for safety and social welfare. This conforms with Nonthapot, Lean (2015), who studied the tourism market in countries in the Mekong region and found that capital investment in tourism by the private sector is the most important factor for tourism supply.

According to the data presented above, when considering tourism supply, it was found that the analysis of tourism efficiency by SFA in Asia Pacific as a whole regionhas not yet appeared in studies. When considering the key variables, Nonthapot and Lean (2015); Nonthapot (2017) found that private sector investment in tourism is the most important factor for tourism in the countries in the Mekong sub-region. This is in line with Anumat (2013), who found that production volume and the expenditure of the government on transportation are factors that generate higher revenue in the tourism industry, leading to national economic growth.

Furthermore, Machmud, Nandiyanto, Dirgantari (2018) also explored the variable of market share and analyzed the technical efficiency of the chemical industry in Indonesia by SFA. It was found that market share has a negative effect on technical efficiency. This means the improvement of chemical industry efficiency requires an increase in market share. Chen (2007) studied and analyzed the efficiency of expenditure on international tourism in Taiwan in order to evaluate hotel efficiency. He found that hotels in Taiwan were 80 percent efficient on average. Operation is the factor that significantly affects hotel efficiency. The efficiency of chain-affiliated hotels is higher than that of independent hotels. The study on hotel industry efficiency in Malaysia by Saleh, Assaf, Nghiem (2012) revealed that the analyzed hotels in Taiwan were 66 percent efficient on average, implying that

large hotels have higher efficiency than small ones. The study of Untong *et al.* (2011) was an assessment of operational efficiency and technological gaps in hotels and guesthouses in Thailand. It was found that hotels with international investment had higher operational efficiency than other groups. In contrast, motels were the group with the lowest operational efficiency. This is in accordance with the study on the measurement of efficiency of leading travel agencies and the hotel industry in many Asia Pacific countries. It was found that travel agencies and the hotel industry in Australia, Singapore, and South Korea had the highest efficiency, which suggests that international hotels in the region have higher levels of efficiency than local ones (George Assaf 2011).

Zhang and Jensen (2007), stated that trade openness is vital to tourism supply which concurred with the findings of Levine and Renalt (1992); Levine and Carkovic (2002), found that trade openness was significantly related to the ratio of investment to national GDP. The study of Krishna, Alicia and Kim (2005) focused on the increase of production efficiency from trade openness and investment from other countries. It was found that the variables of human capital and trade openness were significantly related to the reduction of production efficiency.

Moreover, Lapsatid (2007), who found that trade openness increased production inefficiency. This might be because countries with high trade openness have greater reliance on exports and imports. There are several factors determining the level of imports and exports, *e.g.,* the exchange rate, demand & supply in the global market, and so on. The study of Borensztein, De-Gregorio and Lee (1998) found that developing countries relied on high volumes of materials and factors of production from other countries, reducing their own production efficiency development. Thus, higher trade openness can increase inefficiency.

2. Methodology

2.1 Data Used for the Study

This is a quantitative research. The data used for analysis was cross-section secondary data from 2010 – 2019, consisting of tourism revenue (Y); (2) total contribution to employment (L); (3) government expenditure on tourism (G); (4) capital investment in tourism (I); (5) trade openness (O); (6) market share (M); and (7) time (T) or the year of data collection in each Asia Pacific country.

2.2 Data Collection

Secondary data were used to collect all related data from 1-year databases from 2010 – 2019, a total of 23 data sets.

(1) Tourism revenue: The tourism revenue data were collected from the statistical reports of the World Bank (2020), which defined this variable as tourism expenditure in the considered countries. It covered travel expenditure and revenue from money spent on products as well as services in destination countries. The expenditure was converted into USD at the rate at that time (The World Bank 2020);

(2) Total contribution to employment: The data of total contribution to employment were collected from the statistical reports of the World Travel & Tourism Council (2020a), which defined this variable as the amount of revenue from tourism employment, both directly and indirectly;

(3) The government expenditure on tourism: The data of the government expenditure on tourism were collected from the statistical reports of the World Travel & Tourism Council (2020c), which defined this variable as government expenditure on direct tourism services for tourists, e.g., cultural services (museums), recreation (national parks), etc.;

(4) Capital investment in the tourism sector: data on capital investment in the tourism sector was collected from the statistical reports of the World Travel & Tourism Council, 2020d) as the study of Nonthapot and Lean (2015) employed "capital investment in the tourism sector" as an independent variable affecting the tourism supply of foreign tourists. The World Travel & Tourism Council defined this variable as expenditure on investment by all industries directly involved in tourism and by other specific tourism industries, *e.g.,* new accommodation, transportation, restaurants, and recreational places for tourists;

(5) Trade openness: This was based on the total exports, total imports, and GDP of each country. The data were obtained from the reports of CEIC. In this regard, Zhang and Jensen (2007) found that trade openness, measured by total exports plus total imports and divided by GDP, was related to tourism supply;

(6) Market share: This was based on the number of tourists in each country. Data from the reports of CEIC were used.

2.3. Data Analysis

2.3.1. Research Model

Based on the related concepts, theories, and research papers in the literature review, the researcher designed a model that included the related variables. The model was employed to determine the relationship between the independent and dependent variables following the stochastic production frontier (SPF) under the Cobb-Douglas form in a natural logarithm, as displayed in Equation 2.1 below.

$$ln\, Y_{it} = \beta_0 + \beta_1\, ln\, L_{it} + \beta_2\, ln\, G_{it} + \beta_3\, ln\, I_{it} + \beta_4\, ln\, T_{it} + v_{it} - u_{it} \quad 2.1$$

This research determined two variables to describe the inefficiency of tourism revenue production in countries in the Pacific sub-regions: trade openness and market share. Therefore, the equation of the inefficiency of tourism revenue production in countries in the Pacific sub-regions was determined as shown below.

$$u_{it} = \delta_0 + \delta_1 O_{it} + \delta_2 M_{it} + w_{it} \quad 2.2$$

The basic equation above comprised the following components.

Y = Tourism revenue (USD at the current rate)
β_0 = Constant
β_1,β_2,β_3 = Coefficient of the respective variables.
L = Value of total contribution to employment (USD at the current rate)
G = Government expenditure on tourism (USD at the current rate)
I = Capital investment in tourism (USD at the current rate)
T = Time
O = Trade openness
M = Market share
v = Uncontrollable errors, *e.g.,* climate; with two-sided distribution (Symmetric; v)
u = Controllable errors, *e.g.,* using factors of production, production process, etc; with one-sided distribution (one – side; u)
w = Error
i = 23 studied countries, *i.e.,* i =1 (Australia), i =2 (Bangladesh), i =3 (Cambodia), i =4 (China), i =5 (Fiji), i =6 (India), i =7 (Indonesia), i =8 (Japan), i =9 (Laos), i =10 (Malaysia), i =11 (Maldives), i =12 (,Mongolia), i =13 (Nepal), i =14 (New Zealand), i =15 (Pakistan), i =16 (Philippines), i =17 (Singapore), i =18 (Sri Lanka), i =19 (Thailand), i =20 (Vietnam), i =21 (Hong Kong), i =22 (Macau), i =23 (USA)
t = Period of time from Year 1-10 (2010-2019)

2.3.2 Model Estimation

SPF under the Cobb-Douglas production function form was used for the analysis of production efficiency. The data were analyzed by Frontier 4.1 as shown below.

(1) The production function was analyzed by employing the SPF model, demonstrated in the theory stated in regard to the Cobb-Douglas production equation in Equation (1).
(2) Frontier 4.1 (freeware) was used to estimate the parameters related to the SFA model, estimated by maximum likelihood estimation (MLE).

2.3.3 Analysis of Technical Efficiency

The results of the estimation from 2.3.2 were used to calculate the efficiency of tourism supply in Asia Pacific countries. This test included the analysis of the supply efficiency determining tourism, the analysis of the efficiency of Asia Pacific countries, and the technical efficiency (TE) of the production unit at i, of the stochastic production function. The equation is displayed below (Anumat 2013):

$$TE_{it} = e^{u_{it}} = \frac{Y_{it}}{\int(X_{kit,\alpha})e^{v_{it}}} \quad 2.3$$

Technical efficiency is the ratio of real products per product on the production frontier because the difference between real products and products on the production frontier with error u_{it}out of v_{it} demonstrated the separation by calculating the expected value under the conditions ε_{it} or $[u_{it}/v_{it}]$; $\varepsilon_{it} = v_{it} + u_{it}$. and, when u_i was obtained, it was used to calculate technical efficiency by finding $exp(u_{it})$. So, the technical efficiency (TE) of the production unit at icould be found as presented below:

$$TE_{it} = E\left\{\exp(\frac{u_{it}}{u_{it}+v_{it}})\right\} = \exp\{n - \frac{\sigma_u\sigma_v}{\sigma}\left(\frac{\frac{\varphi(\lambda\varepsilon_{it})}{\sigma}}{1-\theta\left(\frac{\lambda\varepsilon_{it}}{\sigma}\right)}\right) - (\frac{\lambda\varepsilon_{it}}{\sigma})\} \quad 2.4$$

E= Expectation's operator
exp = Exponential
φ = Value of standard normal density function
θ = Value ofcumulative standard normal distribution function
σ = Standard error of ε_i :

$$\sigma = \sigma(\sigma_v^2 + \sigma_u^2)^{\frac{1}{2}} \text{ and } \frac{\sigma_v}{\sigma_u}$$

When the results were considered based on Equation 1 as a pre-test before real use, MLE was employed to analyze the results. The value was calculated by log likelihood function of MLE as per the formula below.

$$LR = -2\{\ln[L]\} \quad 2.5$$

$$L = Log\ likelihood\ function\ of\ MLE$$

The results of the calculated LR were used to test H0 and Ha by referring to the Chi-square table. LR was in the same distribution (χ^2, df, ($2a$)). The values from the opened table were called "critical values," with as many degrees of freedom (df) as the number of limited variables in the test and refer to the level of reliability or statistical significance. For example, a = 95% reliability or statistical significance of 0.05 in the hypothesis test as shown below:

Ho: With efficiency
Ha: With inefficiency

Therefore, with statistical significance of 0.05, when Chi-square is opened, 2a is used for the test. So, if statistical significance was 0.1, and if the critical values were higher than the calculated LR, H0 is accepted, implying that the model is efficient. In contrast, if the critical values are less than the calculated LR, H0 is rejected, implying that the model is inefficient.

3. Result

Battese and Coelli (1995) suggested the estimation of SPF equations and inefficiency equations simultaneously to solve the problem of statistical deviation of two-stage estimation by the simultaneous estimation of equations. This can be done by Frontier. This program estimates the parameters of deviation $\sigma_s^2 = \sigma_v^2 + \sigma_u^2$ and $\gamma = \sigma_u^2/\sigma_s^2; \gamma$between 0 and1. If $\gamma = 0$, it implies there is no inefficiency in the model. If γ> 0, it implies there is inefficiency in the model.

The analysis by SPF model estimation under the Cobb-Douglas and Translog forms revealed the results of SPF model coefficient estimation and inefficiency under the Cobb-Douglas form. It was found to be 0.876, with statistical significance at 99% reliability. For the estimated value obtained, it could be said that there was inefficiency in production. The Translogform was found to be γ> 0, but there was no statistical significance in the Translog form. This indicates that there was no inefficiency. Thus, the model of SPF analysis could be used to describe the production of tourism revenue accurately in the Cobb-Douglas form.

The next step of the analysis was to test whether trade openness and market share affected technical inefficiency in the production process. The test was conducted by usingthe likelihood ratio in order to test "H0: Trade openness and market share do not affect the description of inefficiency in the model, andHa: Trade openness and market share affect the description of inefficiency in the model."Likelihood ratioλ= -2[lnL(H0)-lnL(Ha)]; lnL(H0) is the logarithm of the estimated value from the likelihood function under H0. lnL(Ha) is the logarithm of the estimated value from the likelihood function underHa. The values from the tested distribution in the form of Chi-square with the degree offreedom were equal to the difference in the parameter in the estimation under H0 and Ha. The estimated likelihood ratiofrom the model under the Cobb – Douglasform was ,λ= -2[(-137.75) – (-67.16)] = 141.18, which was higher than the critical value of 11.67at99% reliability; and the degree of freedom = 4. The results rejected H0, confirming that trade openness and market share affected the description of inefficiency in the production model on tourism revenue for the sample, considered under the Cobb – Douglas model.

According to the results of SPF model coefficient estimation under the Cobb-Douglas form displayed in Table 1, it was found that the overall estimated values produces interesting statistical results. To clarify, the coefficient of each variable in the SPF equations and of that of each factor of production could describe the

product elasticity for each factor of production. The results of the study revealed that product elasticity on each factor of production was positive, except for the total contribution to employment (L). Each particular factor was less than 1 for each factor of production, except for government expenditure on tourism (G), which had no statistical significance. The total contribution to employment (L) and capital investment in tourism (I) could describe the production volume per tourism revenue with statistical significance different from 0 at 99 percent reliability. Time (T) could describe production volume per tourism revenue with statistical significance different from 0 at 95 percent reliability.

Table1. Results of SPF Model Coefficient Estimation under the Cobb-Douglas Form

Variables		Cobb – Douglas Coefficients
Stochastic Production		
Constant	β_0	11.157*** (0.158)
Value of total contribution to employment (L)	β_1	-0.259*** (0.040)
Government expenditure on tourism (G)	β_2	0.136 (0.084)
Capital investment in tourism (I)	β_3	0.395*** (0.129)
Time(T)	β_4	0.016** (0.007)
Technical Inefficiency Model		
Constant	δ_0	2.559*** (0.780)
Trade openness (O)	δ_1	-0.138** (0.074)
Market share (M)	δ_2	-0.171*** (0.013)
Other parameters		
σ_s^2		0.167*** (0.027)
γ		0.876*** (0.039)
Log likelihood value		-67.157

Source: From calculation

Note: *** Confidence level 99%; ** Confidence level 95%; () is Standard Deviation

In addition, the results of the study also revealed that capital investment in tourism (I) was an important factor for production per tourism revenue with the coefficient or the elasticity of employed factors of production equalling 0.395. This implies that if other factors are fixed and if capital investment in tourism (I) changes by 1 percent, tourism revenue would change by 0.395 percent. The results indicate that tourism revenue mainly relies on capital investment in tourism. However, total contribution to employment (L) time (T) had elasticity of the factors = -0.259 and 0.016. This indicates that if other factors are fixed, if the tourism sector increased total contribution to employment (L) by 1 percent, tourism revenue would be reduced by 0.259 percent. If Asia Pacific tourism increased the operational time of tourism, revenue would increase by 0,016 percent. The results displayed in Table 1 indicate that the coefficient for government expenditure on tourism (G) was not significantly different from 0. The results indicate that changes in government expenditure on tourismdid not directly affect Asia Pacific tourism revenue.

Apart from the estimated coefficient for each type of factor of production to describe the product elasticity of the factors of production, the sum of the coefficient of each factor of production could be used to describe the time of outcome per size in the production process on tourism revenue, too. Table 1 displays the sum of all factors of production = 0.395 - 0.259 + 0.136 + 0.016 = 0.288, which > 1. This implies that if each factor of production, i.e., capital investment in tourism, total contribution to employment, government tourism expenditure, and time increased by 1 percent, tourism revenue would increase by 0.288 percent. This implies that Asia Pacific tourism revenueinvolves increasing returns to scale.

Table 1 also displays the results of the estimated values of the environmental factors affecting technical inefficiency on Asia Pacific tourism revenue. According to the coefficients estimated in the inefficiency equations, it was found that if the estimated coefficients of the environmental factors were negative, those factors reduced the technical inefficiency of Asia Pacific tourism revenue. However, if the estimated coefficients of the environmental factors were positive, those factors increased the technical inefficiency of Asia Pacific tourism revenue.

Table1 reveals that the coefficients of market share (M) and trade openness (O) were negative and significantly different from 0.171 and 0.138 at 99 percent and 95 percent reliability respectively. The results reveal that if tourism relied more on trade openness policy, and if market share increased, the production inefficiency of Asia Pacific tourism revenuewould be reduced.

Table 2 displays the overall technical efficiency of Asia Pacific tourism revenue. It was found that the lowest technical efficiency of Asia Pacific tourism revenue = 0.145 whereas the highest was = 0.067. The mean indicates that there were no years with tourism revenue less than 0.520; SD = 0.235 - 0.260.

Table 2. The overall technical efficiency of Asia Pacific tourism revenue

Year	Max.	Min.	Mean	Std. Dev.
2010	0.960	0.146	0.519	0.241
2011	0.963	0.152	0.548	0.247
2012	0.965	0.145	0.563	0.256
2013	0.965	0.146	0.567	0.260
2014	0.966	0.156	0.572	0.259
2015	0.967	0.158	0.574	0.256
2016	0.966	0.156	0.565	0.250
2017	0.962	0.159	0.564	0.249
2018	0.960	0.187	0.576	0.240
2019	0.959	0.197	0.574	0.235

Source: From calculation

Table 3 presents the technical efficiency of Asia Pacific tourism revenue, divided into durations and sub-regions. The results of the study reveal that the mean of the technical efficiency of Asia Pacific tourism revenue = 0.546. This means that tourism revenue in Asia Pacific countries, on average, was inefficient. Tourism in each country can actually increase tourism product revenue by 45 percent, based on the current factors of production. According to the analysis of the technical efficiency coefficients of tourism revenue, divided into 2 durations, *i.e.,* 2010 – 2014 and 2015 – 2019, it was found that East Asia had the highest technical efficiency with a coefficient of tourism revenue= 0.657, followed by Southeast Asia, Oceania & the USA, and South Asia (0.613, 0.606, and 0.387, respectively). When considering the durations of tourism revenue, it was found that the first 5 years and the last 5 years of tourism product revenue in East Asia had a higher coefficient of technical production than that of Southeast Asia, Oceania & the USA, and South Asia. This indicates that the coefficient of technical efficiency of East Asia tourism was higher than that of other parts in Asia Pacific. Also, Table 3 reveals that tourism during 2015 – 2019 had higher technical efficiency than during2010 – 2014.

Table 3. Technical Efficiency of Asia Pacific Tourism Revenue

sub-regions	2010 - 2014	2015 – 2019	Average
East Asia [a]	0.650	0.664	0.657
Southeast Asia [b]	0.601	0.624	0.613
Oceania & USA [c]	0.611	0.601	0.606
South Asia [d]	0.372	0.401	0.387
Average	0.559	0.573	0.546

Source: From calculation

Note: a is China, Hong Kong, Japan, Macau and Mongolia

bis Indonesia, Cambodia,Laos, Malaysia, Philippines, Singapore, Thailand and Vietnam

cis Fiji, New Zealand, Australiaand USA

d is Bangladesh, India, Nepal,Pakistan, Sri Lankaand Maldives

Conclusion

In this study, it was found that the factors affecting tourism supply included total contribution to employment, capital investment in tourism, and time. On the other hand, government expenditure on tourism did not affect tourism supply. In regard to the results of the study, the mean of technical efficiency of tourism supply production in Asia Pacific sub-regions = 0.546. This means, that on average, tourism in Asia Pacific countries had inefficient tourism promotion while this sector could actually increase tourism supply by up to 45 percent from the current volume of factors of production. Regarding the results for the technical efficiency measurement of tourism supply, divided into each Asia Pacific sub-regions, the values of the mean were between 0.387 - 0.657. The East Asian countries with the highest technical efficiency were China, Hong Kong, Japan, Macau, and Mongolia. The South Asian countries with the lowest technical efficiency were Bangladesh, India, Nepal, Pakistan, Sri Lanka, and the Maldives. Furthermore, the results of the technical efficiency measurement of tourism supply, divided into years, were between 0.559 - 0.573. The period 2015 - 2019 had the highest technical efficiency while 2010 - 2014 had low technical efficiency. The results of the study on the environmental factors on inefficiency of tourism supply in Asia Pacific revealed that trade openness and increasing market share reduced the inefficiency of tourism supply in Asia Pacific.

When considering capital investment in tourism, it was found to have statistical significance and considerably affected tourism revenue. Apart from having efficiency, it also created the highest benefits for the tourism industry and the economy in other sectors in Asia Pacific countries. This implies that capital investment in tourism brought about increases in several aspects, conforming with the study of Chokcharoen, Nonthapot (2018), who found that capital investment in tourism significantly affected tourism supply in Asia Pacific countries in the same way. Similarly, the study of Untong *et al.* (2011); Nonthapot, Lean (2015) also revealed that capital investment in tourism influences tourism.

Total contribution to employment had statistical significance and affected tourism supply in Asia Pacific countries in the opposite way. To clarify, if the increased efficiency of the total contribution to employment reduced tourism products, it might be because the increase of total contribution to employment reduced tourism revenue. In this regard, the development of the efficiency of tourism personnel to meet international standards enhanced the efficiency of tourism products, leading to economic growth in that country. This is in line with the study of Nangkalaphiwat (2014) who found that in regard to the preparedness of tourism labor, the focus should be put on creating strengths, reducing weaknesses, and developing the right groups of people to achieve a balance in the domestic labor market in this field, which would increase competitive opportunities in the market. Lapsatid (2007), found that the increase of labor force in production reduced efficiency. This is in compliance with the law of diminishing returns in economic theory. The studied countries rely less on the labor force and thus product elasticity tends to increase throughout the year when compared with labor. This suggests that total contribution to employment is necessary for production in Asia Pacific countries.

Time had statistical significance and affected tourism supply in Asia Pacific countries in the same way. To clarify, if the efficiency of time was increased, tourism revenue increased. From the tendency of the past years up until now, it can be seen that tourism efficiency has increased. The level of tourism may be reduced in some years due to situations affecting the stability of the global economy. According to the prediction of the Pacific Asia Travel Association (2019) in a report on tourism during 2019 – 2023, Asia Pacific countries should have around 728.4 foreign tourists, who will create higher revenue. Southeast Asia will have strong growth in revenue from foreign tourists. In the next 5 years, Vietnam will become a leading country in terms of the growth rate per year in tourism, when compared with all destinations in Asia Pacific, followed by Papua New Guinea and Laos. These countries are expected to have higher growth rates per year than the mean of Asia Pacific, which has an expected growth rate of 5.5 percent per year during 2018 – 2023.

Trade openness had statistical significance and affected tourism supply in Asia Pacific countries. According to the results of the study, if trade openness increases, the inefficiency of tourism supply is reduced. Trade openness with high volumes of import-export basically affects an increase in production efficiency of tourism product units so as to be able to compete in the global market. The study of Borensztein *et al.* (1998) revealed that developing countries still rely on high volumes of materials and factors of production from other countries, causing a lack of the production efficiency development on their own. Thus, higher trade openness increase inefficiency for tourism supply.

Pertaining to market share in regard to production inefficiency, it was found that market share had statistical significance and affected tourism supply in Asia Pacific countries. When market share increased, it reduced the inefficiency of tourism supply. This suggests that increased tourism market share in Asia Pacific

countries, or an increase in the international tourism market reduced the inefficiency of tourism supply. This might be because the increase in tourism market share led to self-adjustment and increased the size of the business sector in the tourism industry, over time. Sometimes, it failed to handle or respond in time to the increase in the international tourism market thus resulting in inefficiency. The studies of Untong *et al.* (2011); Machmud *et al.* (2018) also revealed that market share negatively affected technical efficiency, implying that the improvement of industrial efficiency requires an increase in market share through different activities.

According to the results of the study, some useful suggestions are offered to the government and private sectors, including involved agencies in each Asia Pacific country, which can help to determine policies of tourism development in Asia Pacific as presented below.

(1) The results of the study revealed that the role of total contribution to employment affected the efficiency of tourism supply. Thus, both the government and private sectors should promote and develop the labor force in tourism and service industries to meet international standards. Networks for the integration of labor force development in tourism and service industries should be promoted too;

(2) The results of the study revealed that the role of capital investment in tourism affected tourism revenue. Thus, both the government and private sectors should prepare strategies or guidelines to encourage the private sector to invest more. They should also promote investment collaboration with the private sector, along with exchanges in the market and development networks between agencies in the national and international tourism industry in order to promote tourism revenue in each Asia Pacific country;

(3) The governments should provide privileges through tax exemptions or reductions, along with the development of infrastructure in different countries, to encourage tourism investors to make tourism investments in Asia Pacific;

(4) Inefficient countries, *e.g.*, Bangladesh, India, Nepal, Pakistan, Sri Lanka, and Maldives should concentrate more on guidelines or strategies to develop and improve efficiency to enhance their competitive ability;

(5) Countries with high efficiency, *e.g.,* China, Hong Kong, Japan, Macau, and Mongolia should maintain their efficiency and stability and try to apply it in policy to attract more foreign tourists to Asia Pacific.

Acknowledgements

This research was supported by Research and Graduate Studies, Khon Kaen University, Thailand.

References

[1] Amponpan, N. 2015. Report on world tourism trends. *TAT Tourism Journal.* Available at: http://www.etatjournal.com/.

[2] Anumat, P. 2013. *The Measurement of Efficiency in International Tourism Supply of Malaysia, Thailand, and Singapore*. Master of Economics, Chiang Mai University.

[3] Battese, G.E., Coelli, T.J. 1995. A model for technical inefficiency effects in a stochastic frontier production function for panel data. *Empirical Economics,* 20: 387 - 399.

[4] Borensztein, E., De-Gregorio, J., Lee, J.W. 1998. How does foreign direct investment affect economic growth? *Journal of International Economics,* 45, 115 - 135.

[5] Chen, C.F. 2007. Applying the stochastic frontier approach to measure hotel managerial efficiency in Taiwan. *Tourism Management,* 3(28), 696 – 702.

[6] Chokcharoen, N., Nonthapot, S. 2018. Efficient Measurement of Tourism Supply in Asia-Pacific Region Countries. Paper presented at the 7th Academic Management Science 2018. Tak: Kamphaeng PhetRajabhat University.In Tak, Thailand.

[7] Debreu, G. 1951. The coeffcient of resource utilization. *Econometrica,* 19, 273– 292.

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

[9] Koopmans, T.C. 1951. *Activity Analysis of Production and Allocation.* New York, NY: Cowles Commission Monographs, John Willey & Sons.

[10] Krishna, G.I., Alicia, N.R., Kim, K.T. 2005. Measuring Efficiency Externalities from Trade and Alternative Forms of Foreign Investment. *Center for Efficiency and Productivity Analysis.*

[11] Lapsatid, T. 2007. *Testing the Production Efficiency of Foreign Investment Inflows.* Master of Economics, Chulalongkorn University.

[12] Levine, R., Renalt, D. 1992. A sensitivity analysis of cross-country growth regression. *American Economic Review,* 82, 942-963.

[13] Levine, R., Carkovic, M. 2002. *Does Foreign Direct Investment Accelerate Economic Growth*. University of Minnesota, USA.

[14] Machmud, A., Nandiyanto, A.B.D., Dirgantari, P.D. 2018. Technical Efficiency Chemical Industry in Indonesia: Stochastic Frontier Analysis (SFA) Approach. *Pertanika Journal of Science and Technology*, 26 (3): 1453 – 1464.

[15] Nangkalaphiwat, Y. 2014. Preparation of Thai labor in tourism industry for the ASEAN economic community integration. *APHEIT International Journal,* 20 (2), 158-169.

[16] Nonthapot, S., Lean, H.H. 2015. International tourism market analysis in the greater Mekong sub-region: a panel data approach. *Pertanika Journal of Social Sciences & Humanities,* 23(4): 945 – 966.

[17] Nonthapot, S. 2017. Causality between capital investment in the tourism sector and tourist arrivals in ASEAN. *Journal of Advanced Research in Law and Economics.*8(8): 2504-2511.

[18] Nonthapot, S. 2020. The relationships among the five key foreign tourist markets in the greater Mekong sub-region. *Decision Science Letters,* 9(4), 511-520.

[19] Saleh, A.S., Assaf, A.G., Nghiem, H.S. 2012. Efficiency of the Malaysian hotel industry: a distance function approach. *Tourism Analysis,* 17(6), 721-732. DOI:10.3727/10835 4212X13531051127 186.

[20] The Pacific Asia Travel Association. 2019. Travel trends report 2019–2023. Available at: https://www.pata.org/asia-pacific-visitor-forecasts-2019-2023-full-report-now-available/.

[21] The World Bank. 2020a. International tourism, number of arrivals. Available at: http://data.worldbank.org/indicator/ST.INT.ARVL.

[22] The World Bank. 2020b. International tourism receipts. Available at: http://data.worldbank.org/indicator/ST.INT.RCPT.CD.

[23] Untong, A., Kaosa-Ard, M., Ramos, V., Rey-Maquieira, J. 2011. Change in the managerial efficiency and management technology of hotels: an application to Thailand. *Tourism Economics*, 17(3). 565-580, DOI:10.5367/te.2011.0051.

[24] World Tourism Organization. 2020. UNWTO World Tourism Barometer and Statistical Annex. Available at: https://www.e-unwto.org/doi/abs/10.18111 / wtobarometereng.2020.17.1.1.

[25] World Travel & Tourism Council. 2020a. Direct contribution to GDP. Available at: https://tool.wttc.org/.

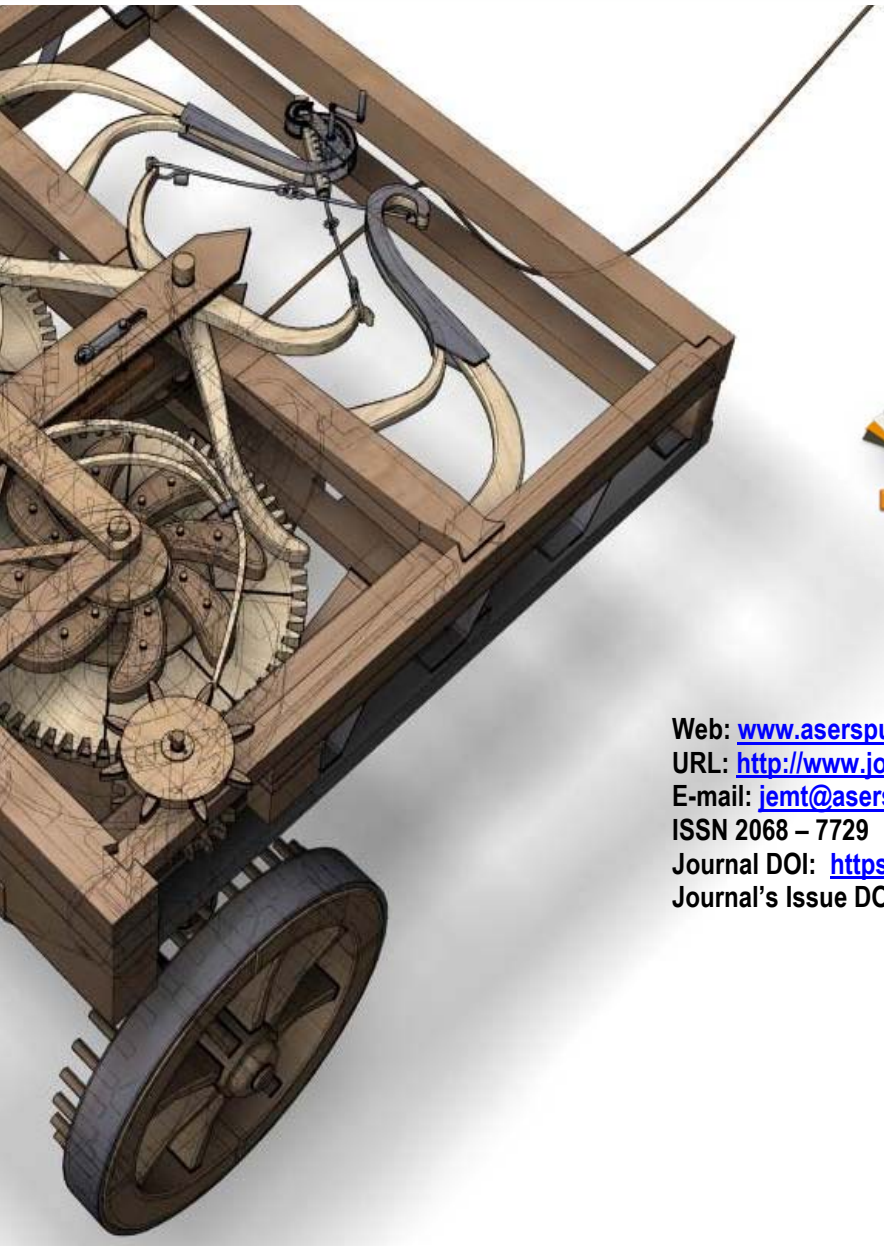
[26] World Travel & Tourism Council. 2020b. Domestic Tourism Spending. Available at: https://www.wttc.org/datagateway/.

[27] World Travel & Tourism Council. 2020c. Government Individual Expenditures. Available at: https://tool.wttc.org/.

[28] World Travel & Tourism Council. 2020d. Capital Investment. Available at: https://www.wttc.org/datagateway/.

[29] Zhang, J., Jensen, C. 2007. Comparative advantage: explaining tourism flows. *Annals of Tourism Research*, 34 (1). 223-243.

ASERS



ASERS Publishing

Web: www.aserspublishing.eu
URL: http://www.journals.aserspublishing.eu/jemt
E-mail: jemt@aserspublishing.eu
ISSN 2068 – 7729
Journal DOI: https://doi.org/10.14505/jemt
Journal's Issue DOI: https://doi.org/10.14505/jemt.v12.4(52).00