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Efficiency Assessment of Tourism Industry in Developing Countries in the Context of Infrastructure: A Two-Stage Super-Efficiency Slacks-Based Measure

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Abstract

Most developing countries cannot earn a substantial share in the global tourism market despite possessing a competitive advantage in resources and tourist attraction potential. This research evaluates tourism industry efficiency in the context of infrastructure using a performance measurement framework based on a two-stage super-efficiency slacks-based measure approach to identify internal sources of this issue. Data from 24 developing countries for the years 2013, 2015, and 2017 are used. In the first stage, the tourism industry efficiency based on infrastructure is divided into two subunits: supporting visitor infrastructure and demand driver infrastructure. Next, the overall efficiency scores are calculated. According to the empirical results, the selected countries mostly had low efficiency in the tourism industry and failed to achieve desired output level relative to their potential. The analysis of this study shows that their unfavorable tourism industry performance results from the lack of infrastructure, undeveloped infrastructure, and the absence of proper strategies to establish and improve infrastructure. These findings contribute an in-depth and useful insight into the relationship between infrastructure status and tourism efficiency, which can be an invaluable step towards improving the tourism industry and consequently achieving economic prosperity and social welfare.

Keywords

Tourism Development, Tourism Infrastructure, Developing Countries, Data Envelopment Analysis, Super Efficiency

1. Introduction

Conventionally, agriculture, production, and international investment have been the only resources for economic development and growth (Chaabouni, 2019). However, recent years have witnessed the tourism industry providing another context for societies' economic development and welfare through direct and indirect positive impacts (Ma & Hassink, 2013; Briedenhann & Wickens, 2004; Matarrita-Cascante, 2010; Tugcu, 2014). According to the literature, tourism by generating income, improving payment balances, and creating jobs, can significantly contribute to overcoming macro-economic issues such as unemployment, inflation, and low foreign exchange earnings (Miller, 2001; Dwyer & Forsyth, 2008; Lee & Brahmasrene, 2013). These impacts can significantly help developing countries achieve economic prosperity. However, many developing countries have not earned a substantial share in the global tourism market while they are able to play an active role in this market using their abundant potential and capacities such as natural attractions, cultural resources, and providing recreational experiences at lower prices than developed countries (WEF, 2019). Tourism has the capability to create jobs and eradicate poverty in developing countries (UNWTO, 2002). The tourism industry has contributed more than 10% of the total GDP worldwide and a similar percentage in employment globally (WEF, 2019). Moreover, the growth of tourism can promote the globalization trend and assemble people from all over the world at a place, leading to familiarity with various cultures and civilizations and cultural exchange; consequently, our awareness of others increases and our culture is enhanced (D'Amore, 1988).

Governments and organizations must provide infrastructure to facilitate tourism development in a region or country since infrastructure plays an essential role in attracting tourists (Abdullah et al., 2014). Many studies have theoretically demonstrated the strong interrelationship between infrastructure and tourism development (Adebayo & Iweka, 2014; Mandić et al., 2018; Seetanah et al., 2011). The continuous growth of this dynamic industry strongly requires investment in tourism infrastructure (Fukushima & Marcelo, 2020). The establishment of appropriate infrastructure brings about great results, such as creating jobs and wealth and facilitating the country's development.

The perspective used in this research categorizes tourism infrastructure into three types: social infrastructure, transport infrastructure, and environmental infrastructure. These three fundamental infrastructures cooperate to make a favorable tourism destination at local, regional, and national levels. Social infrastructure refers to all types of accommodation facilities to house tourists and other physical structures for diverse activities and services. Some instances of such infrastructure are hotels, conference centers, museums, galleries, stadiums, and similar structures. Transport infrastructure, including roads, airports, railways, and waterways, facilitate access to tourism destinations for domestic and international tourists. Environmental infrastructure refers to national and marine parks and natural reserves that can be grounds to serve tourists (Jovanović

& Ivana, 2016).

This study assesses the efficiency of developing countries' tourism industry on a global scale using the fundamental infrastructure in this industry applying a two-stage super-efficiency slacks-based measure framework. Most of the literature on assessing tourism industry efficiency has focused less on developing countries. Since developed countries are currently at a high level of growth, the improvement opportunities are declining in these countries, meaning there is less room for further research about this issue in developed countries than in developing countries (Prorok et al., 2019; Kosmaczewska, 2010). Accordingly, the motivation for focusing on developing countries is that many of these countries cannot efficiently use their potential to improve their tourism industry and still have not achieved high growth in this industry (Assaf & Josiassen, 2012). Therefore, further study should be conducted to identify opportunities and essential strategies for improving and developing the tourism industry in these countries. None of the previous studies evaluated the tourism industry efficiency considering social, transport, and environmental infrastructure simultaneously. Therefore, the novelty of this research is the selection of developing countries on a global scale considering the three mentioned fundamental tourism infrastructures. This research proposes a framework to assess tourism industry efficiency in the context of infrastructure across 24 developing countries over the years 2013, 2015, and 2017. This framework divides tourism efficiency into two subunits of demand driver infrastructure and supporting visitor infrastructure. Demand driver infrastructure attracts tourists to visit destinations, creates travel motivation, increases the length of stay at destinations, and brings about prosperity for the region for tourist reception while supporting visitor infrastructure is recognized as a factor whose quality greatly affects the tourists' degree of satisfaction and encourages tourists to revisit and suggest the destination to others (Tourism & Transport Forum, 2012).

This study answers two critical questions. First, why do some countries have an inefficient tourism industry, and how can they become efficient using their potential in this industry? Second, how does infrastructure significantly affect the tourism industry? Analyzing tourism industry efficiency for developing countries on this scale is a comprehensive effort to achieve clearer insight into the relationship between the infrastructure conditions and tourism.

The rest of the article is as follows: Section 2 presents relevant literature. Section 3 elaborates upon the proposed framework, case study, and variables, and then provides a brief descriptive analysis of the dataset. Section 4 analyzes and interprets the results. Section 5 concludes the article.

2. Literature Review

Data envelopment analysis (DEA) can demonstrate that how well a decision-making unit (DMU) is functioning compared to other DMUs. The ease of use of DEA as an efficiency measurement approach has made it a popular managerial tool in many areas. Acknowledging DEA capability, numerous investigations have applied it in determining the efficiency of different sectors (Emrouznejad & Yang, 2018; Stefaniec et al., 2020; Assani et al., 2018). From various viewpoints, many researchers have evaluated the efficiency and performance of the tourism industry.

The literature in this area can be categorized into three levels. Most studies focus on the micro-level when evaluating the tourism industry, considering hotels, restaurants, travel agencies, and other similar sectors. In this regard, Oukil et al. (2016) evaluated the performance of 58 Omani hotels. In this study, a DEA-bootstrap method was used to measure efficiency scores. Then, a truncated regression model was applied to identify potential sources of operational inefficiency in hotels. The results indicated that most of the hotels were inefficient, and efficient hotels were mostly located in the capital. In addition, the star rating and nearby cultural attractions were found to be the main factors of efficiency for Omani hotels. This study also revealed that efficiency is more easily improved by increasing annual revenue, guests, and accommodation nights. They recommended that future studies use more inputs and outputs and extend the studied period to obtain more reliable results. Assaf and Agbola (2011) calculated the efficiency of 31 hotels across Australia over 2004-2007 using a DEA approach. The findings showed that the hotels' efficiency over the studied years improved in terms of star rating and physical size. Also, hotels situated in cities had better performance than those in suburban areas. Furthermore, the results highlight a significant correlation between technical efficiency, and the hotel star rating and number of rooms. The article by Hsieh and Lin (2010) evaluated 57 international hotels in Taiwan using network DEA and a dataset published in 2007. They investigated the efficiency and managerial issues of international hotels to improve their performance. They noted that future studies should consider larger samples to achieve more accurate and reliable results. Alberca and Parte (2020) assessed the efficiency of tourist apartments and hostels by including 12,864 firm-level instances over the period from 2005 to 2016. The findings showed that firms located in diversified destinations such as Basque, Catalonia, La Rioja, Madrid, and the Canary Islands earned higher regional efficiency scores than those situated in non-diversified destinations. The results of this research can provide practical guidelines for the management of firms. This study also asserts that managerial effectiveness concerning the environmental, business, and macroeconomic factors can influence tourism firms' performance. Using a DEA double bootstrap Method, Assaf and Cvelbar (2010) analyzed the efficiency of 24 major hotels in Slovenia in 2005-2007. The results indicated that star rating, physical size, and annual revenue positively affected hotels' productivity.

Also, some previous studies have assessed the tourism industry on a regional scale. These studies have focused on some particular regions within a country, mainly in developed countries. At the regional level, countries are assessed only based on their activities in the tourism industry. Some cases on a regional scale are given as follows. Chaabouni (2019) evaluated the tourism efficiency of 31 Chinese provinces in the western, central, and eastern regions over the period 2008-2013 by applying a DEA approach. Tourism GDP, capital stock, tourism labor employment were considered inputs, and the number of arrivals was output. The findings indicated that the overall tourism efficiency for Chinese provinces was low in the studied period. This study recommended the government allocate funds to provide adequate context to develop the tourism industry by appropriate policymaking. The study of Nurmatov et al. (2020) was aimed to evaluate the efficiency of 17 Spanish regions using a DEA model over the period 2008-2018. Inputs included the number of tourists, employees, and available bedrooms, and outputs were tourists spending and the total number of overnight stays. The findings indicated that Spanish regions had a growing trend in tourism development during the past decade. Since focusing on Spanish regions limited the generalizability of the results, they recommended future studies to choose bigger samples from international tourist destinations. Cracolici et al. (2007) applied a DEA approach to investigate the tourist competitiveness of 103 regions in Italy. The results showed that inappropriate strategic actions from public organizations, insufficient dedicated financial resources to tourism infrastructure, and lack of governmental support from local tourist regions resulted in a negligible change in tourism efficiency from 1998 through 2001. Using an output-oriented DEA model, Karakitsiou et al. (2020) assessed the hotel and restaurant sector in all regions of Greece over 2002-2013. In this study, the inputs were the number of local units, number of employees and investments, and turnover considered the output. Their findings indicated that most of the regions are inefficient, and local authorities need to balance inputs and outputs. They also suggested that each region should implement specific policies to achieve tourism growth. Barros et al. (2011) applied a DEA model to compare and assess the performance of 22 tourism destinations in France over the period 2003-2007. They considered the number of hotels and camping and tourist arrivals as the inputs and nights slept as the output. According to their study, proximity to features such as sea, sun, and beaches increased the tourism efficiency of France's regions. Besides, the development of natural parks, museums, and ski resorts can improve tourism efficiency if they induce tourists to stay longer at destinations. Cuccia et al. (2016) used a DEA two-stage framework to assess the impact of the UNESCO World Heritage List (WHL) on 21 Italian regions over the period 1995-2010. Next, they used a regression model to investigate factors affected efficiency scores. In this study, tourist arrivals and the total number of accommodation establishments were considered inputs, and bed-nights were selected as the output. Bi et al. (2011) assessed the tourism efficiency of 31 Chinese provinces, using a DEA model and a dataset published in 2007. The research aimed to identify the tourism industry's inefficiency causes and provide insight for local authorities and tourism enterprises. The results revealed a large difference between regions' efficiency and much room for improvement in some regions. To achieve a more exhaustive analysis, they suggested subsequent research to regard more in-depth factors such as tourist satisfaction, service quality, and governmental support.

Finally, a limited number of previous studies have evaluated tourism efficiency on a continental or global scale. These studies provide an assessment framework to compare the performance of real competitors across a large sample of countries. In the following, we refer to some examples on this level. Hadad et al. (2012) evaluated the tourism efficiency at the macro-level and ranked 105 countries, using a DEA method and data for 2009. They considered natural and cultural resources, the number of employees, and rooms as the inputs, with the number of tourists and receipts per tourist acting as the outputs. Their findings indicated that globalization is critical for tourism efficiency in developing countries. They also found that, in both developed and developing countries, labor productivity directly correlates with tourism industry efficiency. Radovanov et al. (2020) assessed the tourism development efficiency while considering sustainability factors for 27 EU countries and five Western Balkan countries over 2011-2017 using an output-oriented DEA model. The input used was government expenditure, and the outputs were average receipts per arrival, travel and tourism industry employment, and sustainable development of the tourism industry. Their results showed that the EU 15 countries obtained higher efficiency scores than new EU members and Western Balkan countries. Also, those findings suggest that a larger sample and a more extended period should be considered to achieve more thorough insight into sustainable tourism development. Utilizing an output-oriented DEA model, Soysal-Kurt (2017) measured the relative tourism efficiency of 29 European countries over 2013. In this research, the inputs were the tourism expenses, number of employees, and number of beds, and the outputs were the tourism receipts, tourist arrivals, and number of overnight stays. All the variables considered effective on the tourism industry efficiency. A limited number of variables were included in this research because of the lack of access to associated data. Therefore, that paper suggested incorporating more relevant variables to achieve a better analysis. Kosmaczewska (2010) assessed the productivity of 29 EU countries over 2007-2009 using an output-oriented DEA model. The input was arrivals in tourist accommodation units, and the outputs were the total number of accommodation establishments and gross domestic product per capita. The results indicated that the inefficiency causes of poorer countries stem from inappropriate managerial policies at the national level. Also, the inefficiency reasons of richer countries originate from the limited and gradual growth of tourism efficiency due to tourism's entrenched role in the national economy.

According to the relevant literature, none of the previous studies have regarded social, transport, and environmental infrastructure to assess tourism industry efficiency simultaneously. Moreover, most studies in this area have mainly focused on developed countries. Therefore, this article aims to present a framework to investigate the status of the tourism industry in developing countries on a global scale more precisely and comprehensively by considering three essential tourism infrastructure types. This framework is based on the super-efficiency SBM model proposed by Tone (2002).

3. Method and Material

3.1. Conventional DEA Model

DEA comprises techniques and methods to analyze data related to inputs and outputs of homogenous DMUs. It is a non-parametric mathematical approach based on linear optimization. Farrell first introduced the non-parametric approach for measuring efficiency in 1957. He defined a set, called the production possibility set (PPS), which included all possible combinations of inputs and outputs, and specified a part of its frontier as the production function. DMUs on the frontier are called efficient units, and other DMUs are considered inefficient units. Accordingly, the frontier is referred to as the efficient frontier (Farrell, 1957). DEA is founded on Farrell's work and developed by Charnes et al. (1978) to evaluate the efficiency of DMUs with multiple inputs and multiple outputs. Efficient units are benchmarks for inefficient ones.

Assume that we want to investigate the efficiency of n DMUs, each of which utilities m inputs to generate s outputs. The efficiency score of the observed decision-making unit (DMUo), under the constant return to scale assumption, is calculates as follows (Charnes et al., 1978):

$$
\begin{aligned}
&\max \theta_o = \frac{\sum_{r=1}^{s} u_r y_{r0}}{\sum_{i=1}^{m} v_i x_{i0}} \\
&\text{s.t.} \\
&\frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \le 1 \quad j,\left(j = 1, 2, \cdots, n\right) \\
&u_r, v_i \ge 0 \quad r, i\left(r = 1, 2, \cdots, s\right)\left(i = 1, 2, \cdots, m\right)
\end{aligned}
\tag{1}
$$

In Equation (1), the x_{i0} shows the amount of input i consumed by DMU_O, and y_{r0} indicates the amount of output r generated by DMU_O. DEA does not require assigning predetermined weights to variables and assigns weights to inputs and outputs by itself. The u_r and v_i represent weights designated to outputs and inputs, respectively. Since DEA uses a set of observations to determine the relative efficiency of DMUs, at least one DMU lies on the efficient frontier. The efficient DMUs produce greater outputs using the same amount of inputs as inefficient ones or generate the same amount of outputs by using the lower level of inputs. These DMUs are given an efficiency score of 1, whereas inefficient DMUs get an efficiency score between 0 and 1. It should be noted that triple the sum of inputs and outputs should be less than the number of DMUs to get sufficient discriminatory power for the model.

3.2. First Stage of Two-Stage Super-Efficiency SBM Framework

To evaluate the efficiency and compare the performance of the tourism industry in developing countries (DMUs) in the context of infrastructure, we applied a performance measurement framework based on a two-stage super-efficiency SBM approach. The used super-efficiency technique can distinguish not only the efficient countries but also rank them. Tone first introduced the SBM model in 2001 and the super-efficiency SBM approach in 2002. The SBM is a non-radial method, and In contrast to radial models, it discards the assumption of proportionate reduction in inputs (input-oriented) and a commensurate increase in outputs (output-oriented) to reach the efficient frontier and directly deals with input excesses and output deficits (slacks). Furthermore, SBM is invariant regarding the units of data and monotone declining in all slacks. In this study, the output-oriented super-efficiency SBM is used since we aim at increasing the tourist arrivals and tourism receipts.

Assume that there are n DMUs with input and output matrices $X = (x_{ij}) \in R^{m\times n}$ and $Y = (y_{ij}) \in R^{s\times n}$, respectively. Also, the dataset is positive, i.e., $X > 0$ and $Y > 0$. The production possibility set P is then expressed as

$$P = \{(x, y) \mid x \ge X\lambda, y \le Y\lambda, \lambda \ge 0\}. \tag{2}$$

The λ is a non-negative vector in R^n. The mathematical program of SBM for the observed decision-making unit, denoted as DMU_O, is formulated as follows (Tone, 2001). Note that this model should be solved n times to compute the efficiency scores of all the DMUs.

$$\begin{aligned} p^* = \min \rho = \frac{1-\frac{1}{m}\sum_{i=1}^{m} s_i^- / x_{i0}}{1+\frac{1}{s}\sum_{r=1}^{s} s_r^+ / y_{r0}} \\ \text{s.t.} \quad x_0 = X\lambda + s^-, \\ y_0 = Y\lambda - s^+, \\ \lambda \ge 0, s^- \ge 0, s^+ \ge 0. \end{aligned} \tag{3}$$

Vectors $s^- \in R^m$ and $s^+ \in R^s$ denote the input excesses and output deficits, respectively. The value of p, which represents the efficiency score, ranges from 0 to 1. It should be noted that DMU_o is efficient if and only if $p^* = 1$. This case is equivalent to the condition in which s^{-*} and s^{+*} equal zero. In other words, there is no input excess and output deficit. For all efficient DMUs, the production possibility set spanned by (X, Y) excluding (x_0, y_0) is as follows:

$$P \setminus (x_0, y_0) = \left\{(\bar{x}, \bar{y}) \mid \bar{x} \ge \sum_{j=1,\ne 0}^{n} \lambda_j x_j, \bar{y} \le \sum_{j=1,\ne 0}^{n} \lambda_j y_j, \bar{y} \ge 0, \lambda \ge 0\right\}. \tag{4}$$

Further, a subset $\bar{P}/(x_0, y_0)$ is expressed as:

$$\bar{P}/(x_0, y_0) = P \setminus (x_0, y_0) \cap \{\bar{x} \ge x_0 \text{ and } \bar{y} \le y_0\}. \tag{5}$$

The weighted distance from (x_0, y_0) *to* $(\bar{x}, \bar{y}) \in \bar{P} \setminus (x_0, y_0)$ is then determined as follows:

$$\delta = \frac{\frac{1}{m}\sum_{i=1}^{m} \bar{x}_i / x_{i0}}{\frac{1}{s}\sum_{r=1}^{s} \bar{y}_r / y_{r0}} \tag{6}$$

In Equation (6), the numerator and denominator involve weighted distances from x_0 to $\bar{x}(\geq x_0)$ and y_0 to $\bar{y}(\geq y_0)$, respectively. Therefore, if the exclusion of the DMU (x_0, y_0) change the production possibility set P, then δ is bigger than 1. The super-efficiency SBM of (x_0, y_0), is then formulated as follows (Tone, 2002):

$$\begin{aligned} \delta^* &= \min \delta = \frac{\frac{1}{m}\sum_{i=1}^{m} \bar{x}_i / x_{i0}}{\frac{1}{s}\sum_{r=1}^{s} \bar{y}_r / y_{r0}} \\ \text{s.t. } & \bar{x} \geq \sum_{j=1,\neq 0}^{n} \lambda_j x_j, \\ & \bar{y} \leq \sum_{j=1,\neq 0}^{n} \lambda_j y_j, \\ & \bar{x} \geq x_0 \text{ and } \bar{y} \leq y_0, \\ & \bar{y} \geq 0, \lambda \geq 0. \end{aligned} \tag{7}$$

Finally, the output-oriented super-efficiency SBM program is formulated as follows:

$$\begin{aligned} \delta_O^* &= \min \delta = \frac{1}{\frac{1}{s}\sum_{r=1}^{s} \bar{y}_r / y_{r0}} \\ \text{s.t. } & \bar{x} \geq \sum_{j=1,\neq 0}^{n} \lambda_j x_j, \\ & \bar{y} \leq \sum_{j=1,\neq 0}^{n} \lambda_j y_j, \\ & \bar{x} = x_0, 0 \leq \bar{y} \leq y_0, \lambda \geq 0. \end{aligned} \tag{8}$$

The DMUs that are given an efficiency score greater than or equal to one are efficient, whereas inefficient DMUs get an efficiency score between 0 and 1.

Using Equation (8), in the first stage, the proposed efficiency assessment framework divides the overall efficiency into two subunits, namely, demand driver infrastructure efficiency and supporting visitor infrastructure efficiency (**Figure 1**). The decomposition of the overall efficiency make our model more discriminative than the conventional DEA models, and it better detects the inefficiency causes for DMUs (Wu et al., 2016; Hosseini & Stefaniec, 2019).

3.3. Second Stage of Two-Stage Super-Efficiency SBM Framework

In this stage, the overall efficiency, combining demand driver infrastructure

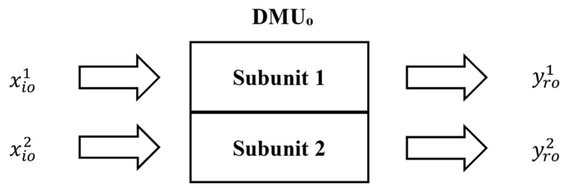

Figure 1. Illustration of the first stage in the proposed efficiency assessment framework with x_{io} indicating input and y_{ro} denoting output.

efficiency (subunit 1) with supporting visitor infrastructure efficiency (subunit 2), is measured. For this purpose, a dummy variable with a value of 1 is considered as sole input, and efficiency scores of subunits 1 and 2 are considered as outputs. The use of the dummy input in the absence of a specific and explicit input is useful to identify the most efficient DMU (Toloo, 2013), as well as to integrate different activities of a DMU (Yang, 2006). To describe the second stage, assume that there are n DMUs with dummy variable 1 as the input, and demand driver infrastructure efficiency score (δ_1^*) and supporting visitor in-frastructure efficiency score (δ_2^*) as the outputs. Then, the overall efficiency score of DMUo is calculated using Equation (8).

3.4. Case Study

This study evaluates the tourism efficiency of 24 developing countries, with the highest number of UNESCO World Heritage Sites (WHSs) over the period 2013-2017 (UNESCO, 2020), using a two-stage super-efficiency SBM model. The existence of WHS in a country positively affects tourist destinations, provides a competitive advantage for the country, and fosters tourism demand (Yang et al., 2010). Therefore, countries having WHS receive more attention from tourists. Accordingly, the selected countries have the initial potential to improve their tourism industry, and they can enhance their tourism attraction, employment rate, income generation, and facilitate the path to social welfare. All selected countries have been recognized as developing countries by the International Monetary Fund (IMF, 2019); these are China, India, Mexico, Russia, Iran, Brazil, Turkey, Poland, Peru, Argentina, Croatia, Bulgaria, South Africa, Colombia, Ethiopia, Indonesia, Morocco, Hungary, Romania, Sri Lanka, Tunisia, Vietnam, Egypt, and Ukraine.

In this study, we assess the tourism efficiency of 24 developing countries in the years 2013, 2015, and 2017 to make the efficiency analysis dynamic. In this case, each country is dealt with as an independent DMU each year. This approach is useful when we intend to assess a DMU over a period and analyze the efficiency changes. We compute the tourism efficiency of each country every two years because tourism infrastructure is gradually established and improved. Therefore, due to the nature of selected inputs and outputs, this approach can more properly reflect the efficiency changes during the selected period.

3.5. Input and Output Variables

Although DEA is an excellent and popular technique to assess tourism efficiency, it has some limitations when DMUs are less than triple the number of variables. This problem can be solved by choosing the inputs and outputs that play the main role in the performance of the tourism industry. Thus, not only the adverse effects on the results are avoided, but also the discriminatory power of the model is increased. Therefore, considering tourism infrastructure, this study incorporates the inputs and outputs that significantly affect the tourism industry and better represent the performance efficiency of the countries.

According to **Figure 2**, this study categorizes tourism infrastructure into three types: social infrastructure, transport infrastructure, and environmental infrastructure. The social infrastructure is considered in this study by using the number of hotel rooms and the number of stadiums as inputs. The tourism industry is integrated of various activities, services, and infrastructure, in which accommodation establishment is one of the main components. A hotel is an accommodation establishment with different qualities and ratings from one to five stars depending on facilities and the number of rooms and beds. Easy access to hotels with sufficient quality can provide a competitive advantage for a country (WEF, 2019). Another important social infrastructure in tourist destinations is stadiums, which attract tourists interested in sports events. The development of sport significantly affects various parts of today's life at the micro and macro level. An aspect of these effects is the emergence of a phenomenon in the tourism industry called sports tourism (Tourism & Transport Forum, 2012). Sports tourism is formed by linking tourism with sport and is considered an appealing goal of travel.

The transport infrastructure is known as a vital determinant for tourism development (Khadaroo & Seetanah, 2008). Therefore, planning for and investing in the development and improvement of transport infrastructure should be regarded as a tool for enhancing tourism competitiveness and economic development. Lack of attention to transport infrastructure' adequacy and quality makes the tourism industry practically inefficient or weak (Dinu, 2018). Regarding inputs related to transport infrastructure, the number of airports having at least one scheduled flight per million urban population is selected to represent air transport infrastructure. For ground transport infrastructure, the total length of railroads, which includes the existing railroad network in a country, regardless of the number parallel of paths, and the total length of roads, which includes all roads in a country, are considered.

In this study, the input used to represent environmental infrastructure is the number of national parks. National park refers to natural features such as forests, pastures, plains, rivers, lakes, and mountains. Countries having such natural capitals try to protect them in line with national interests. These natural areas are spaces for attracting tourists at the national and international level, and different countries attempt to establish required facilities around these areas with the least environmental damage. Countries with environmental infrastructure benefit from a competitive advantage in attracting tourists.

The outputs are international tourist arrivals (in 1000 persons), which shows the number of tourists who arrive in the country in a year, and International tourism inbound receipts (in million USD), indicating the total amount of money spent by tourists in the destination country in a year.

Figure 2 shows that environmental infrastructure falls into the demand driver infrastructure category, transport infrastructure is classified as supporting visitor

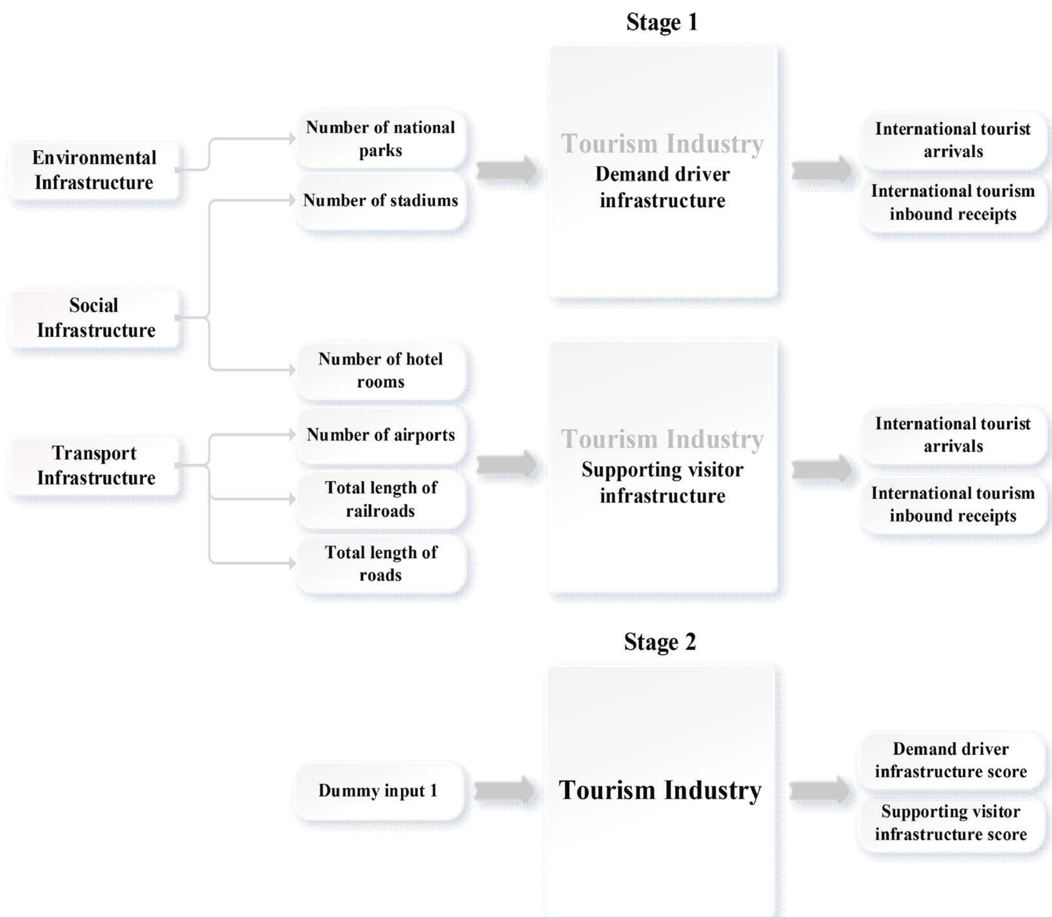

Figure 2. Illustration of the proposed two-stage DEA framework.

infrastructure, and social infrastructure falls into both demand driver infrastructure and supporting visitor infrastructure. Accordingly, the number of national parks and the number of stadiums are considered the inputs for the demand driver infrastructure subunit. The number of hotel rooms, the number of airports, the total length of roads, and the total length of railroads are regarded as the inputs of supporting visitor infrastructure subunit. International tourist arrivals (in 1000 persons) and international tourism inbound receipts (in million USD) are considered the outputs for both subunits in the first stage. It is noteworthy that demand driver infrastructure affects tourist arrivals more than tourism receipts, while the supporting visitor infrastructure affects tourism receipts more than tourist arrivals (Tourism & Transport Forum, 2012). In the second stage of the proposed framework, the overall efficiency, which is a combination of efficiencies related to demand driver infrastructure (subunit 1) and supporting visitor infrastructure (subunit 2), is obtained. In this stage, a dummy variable 1 is considered the only input, and efficiency scores for both subunits are considered the outputs.

In this study, the data for 24 countries with the highest number of WHSs over the years 2013, 2015, and 2017 are used. The data were extracted from The World Bank (2020), The World Database on Protected Areas (WDPA, 2020), World

Economic Forum (WEF) published in 2015, 2017, and 2019 (WEF, 2015, 2017, 2019), and World Tourism Organization (UNWTO, 2020).

The descriptive statistics of the collected data are given in **Table 1**. It shows that China has the greatest tourist arrivals over the studied period, while Ethiopia has the least number of tourists. Regarding the inbound receipts, the highest amount of money spent by tourists is for China, and the lowest amount in 2013, 2015 and 2017 is associated with Ethiopia, Ukraine and Tunisia respectively.

In addition, correlation analysis for inputs and outputs was calculated. Correlation coefficients for subunits of demand driver infrastructure and supporting visitor infrastructure are demonstrated in **Table 2**. The correlation coefficients are positive, implying that appropriate inputs and outputs were selected for the proposed efficiency assessment framework.

Table 1. Descriptive statistics, 2013-2017.

Variables	Mean	SD	Min	Max
Demand driver infrastructure inputs				
Number of national parks	38	44	3	224
Number of stadiums	29	32	4	141
Supporting visitor Infrastructure inputs				
Number of hotel rooms	299,305	352,944	20,234	1,539,141
Number of airports	46	52	2	222
Railroad length (km)	16,709	21,690	597	81,936
Road length (km)	717,264	1,295,859	17,488	5,301,158
Demand driver and Supporting visitor infrastructure outputs				
International arrivals (In thousand persons)	13,426	13,468	681	60,740
Inbound receipts (In million USD)	10,670	10,891	1700	56,400

Source: Author's own. Data extracted from The World Bank (2020), WDPA (2020), UNWTO (2020), and WEF (2015, 2017, & 2019).

Table 2. Spearman's correlation coefficients of variables, 2013-2017.

	National parks	Stadiums	Rooms	Airports	Railroads	Roads	International arrivals	Inbound receipts
National parks	1							
Stadiums	0.670	1						
Hotel rooms	0619	0.682	1					
Airports	0.873	0.802	0.674	1				
Railroads	0.428	0.635	0.414	0.500	1			
Roads	0.770	0.778	0.556	0.796	0.727	1		
International arrivals	0.203	0.292	0.397	0.217	0.593	0.457	1	
Inbound receipts	0.541	0.536	0.557	0.556	0.543	0.711	0.783	1

Source: Author's own. Correlation coefficients obtained using the SPSS Statistics Software.

4. Results and Discussion

4.1. Empirical Results

In this study, a two-stage super-efficiency SBM approach is applied to evaluate the tourism industry efficiency in 24 countries focusing on the infrastructure and considering the years 2013, 2015, and 2017. In the first stage of the proposed model, six inputs and two outputs are used to evaluate the efficiency of the demand driver infrastructure (subunit 1) and supporting visitor infrastructure (subunit 2). In the second stage, to compute the overall efficiency of the tourism industry in each country, a dummy variable equaling 1 is used as the only input, and efficiency scores of subunits 1 and 2 from the first stage are considered the outputs. The results of the proposed efficiency assessment framework are given in **Table 3** and **Figure 3**. The mean efficiency scores of both subunits and the mean overall efficiency for each DMU in the whole study period are shown in **Table 4**. According to the results obtained from the super-efficiency SBM model, the countries with an overall efficiency of 1 or higher are called efficient, indicating that they used their maximum potential and succeeded in achieving the desired output level relative to their inputs. The other countries with an overall efficiency score lower than 1 are called inefficient, showing that they failed to attain a favorable output level compared to their resources. In the following, the results of this evaluation are elaborated for more understanding and elucidation.

Table 4 shows that Turkey and China are the most efficient countries in the study period among the selected developing countries; they are ranked first and second, respectively, in the overall efficiency. Therefore, both countries can be benchmarks for the inefficient developing countries. Romania, Ethiopia, and Columbia have the least efficient performance over the whole period.

Turkey is the only country that has achieved an efficiency score higher than 1 in both subunits of demand driver infrastructure and supporting visitor infrastructure. Also, Turkey is among the few countries that used its maximum potential in transport, environmental, and social infrastructure. In the studied years, the development of Turkey's tourism industry in attracting international tourists peaked in 2015 when it reached near 40 million tourists (UNWTO, 2016). The growth of Turkey in this industry results from actions like constructing well-equipped hotels and other accommodation facilities, developing airlines and establishing Turkish flights to most parts of the world, and paying attention to hospitality (Okuyucu, 2013). With strong transport and accommodation infrastructure and optimal usage of this infrastructure, China achieved the first rank in the subunit of supporting visitor infrastructure among other countries with an efficiency score of 1.636. The growth of China's tourism industry during the studied period can be seen in 2017 when it attracted 60 million tourists (UNWTO, 2018). This success is the result of executing appropriate policies for tourism infrastructure development (Zhong et al., 2015). India earned the greatest average receipts per tourist (2040 USD) among studied countries in the whole period. India is ranked second and third regarding the efficiency score

Table 3. Efficiency scores of selected developing countries for the period 2013-2017.

Country	Year	Supporting visitor infrastructure efficiency	Demand driver infrastructure efficiency	Overall efficiency
Argentina	2013	0.334	0.218	0.264
	2015	0.353	0.234	0.281
	2017	0.388	0.264	0.314
Brazil	2013	0.341	0.219	0.267
	2015	0.336	0.219	0.265
	2017	0.310	0.230	0.264
Bulgaria	2013	0.449	0.377	0.410
	2015	0.418	0.350	0.381
	2017	0.585	0.428	0.494
China	2013	1.714	0.979	1.347
	2015	1.581	0.895	1.232
	2017	1.612	0.860	1.226
Colombia	2013	0.244	0.194	0.218
	2015	0.273	0.221	0.244
	2017	0.311	0.251	0.277
Croatia	2013	0.813	0.455	0.584
	2015	0.861	0.497	0.630
	2017	1.338	0.598	0.930
Egypt	2013	0.449	0.432	0.440
	2015	0.480	0.364	0.414
	2017	0.535	0.380	0.444
Ethiopia	2013	0.356	0.171	0.231
	2015	0.379	0.181	0.245
	2017	0.310	0.190	0.235
Hungary	2013	0.707	0.426	0.532
	2015	1.136	0.481	0.699
	2017	1.127	0.539	0.796
India	2013	1.449	0.466	0.793
	2015	1.542	0.496	0.845
	2017	0.487	0.628	0.549
Indonesia	2013	0.383	0.408	0.395
	2015	0.439	0.471	0.454
	2017	0.494	0.564	0.528
Iran	2013	0.410	0.252	0.313
	2015	0.507	0.297	0.374
	2017	0.528	0.286	0.371

Continued

Mexico	2013	0.591	0.469	0.523
	2015	0.778	0.598	0.676
	2017	0.936	0.704	0.803
Morocco	2013	0.664	0.463	0.546
	2015	0.669	0.488	0.564
	2017	0.822	0.606	0.698
Peru	2013	0.270	0.218	0.241
	2015	0.281	0.225	0.250
	2017	0.298	0.248	0.271
Poland	2013	0.899	0.608	0.725
	2015	0.945	0.621	0.750
	2017	1.072	0.682	0.863
Romania	2013	0.211	0.195	0.203
	2015	0.241	0.206	0.222
	2017	0.310	0.247	0.275
Russia	2013	1.001	0.842	0.919
	2015	0.687	0.702	0.694
	2017	0.674	0.660	0.667
South Africa	2013	0.767	0.398	0.524
	2015	0.698	0.391	0.502
	2017	0.887	0.442	0.590
Sri Lanka	2013	0.445	0.207	0.282
	2015	0.521	0.261	0.348
	2017	1.137	0.286	0.586
Tunisia	2013	0.366	0.363	0.365
	2015	0.288	0.300	0.294
	2017	0.350	0.334	0.342
Turkey	2013	1.316	1.228	1.272
	2015	1.695	1.403	1.549
	2017	1.703	1.404	1.554
Ukraine	2013	1.372	1.085	1.229
	2015	0.652	0.360	0.464
	2017	0.667	0.356	0.464
Vietnam	2013	0.406	0.368	0.386
	2015	0.415	0.377	0.395
	2017	0.480	0.504	0.492

Source: Author's own. Results obtained using the BT DEA Solver Software.

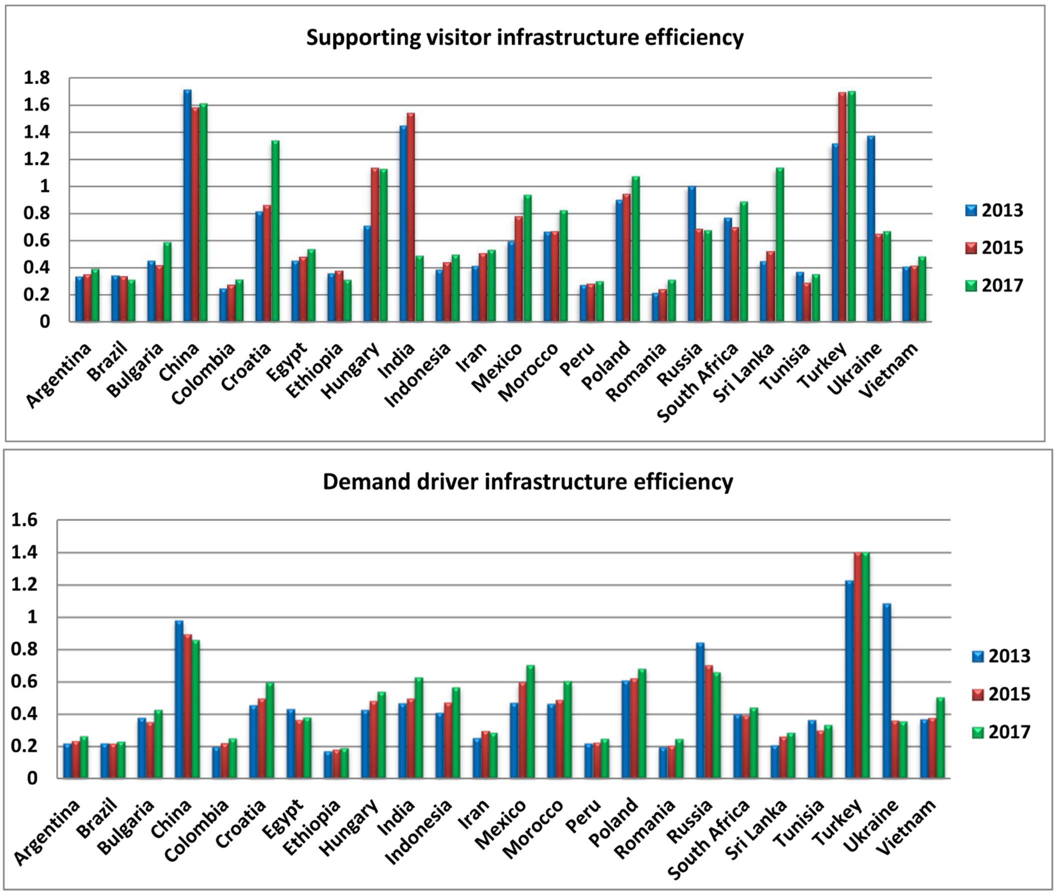

Figure 3. Illustration the demand driver infrastructure and supporting visitor infrastructure performances based on the super-efficiency SBM model.

Table 4. Arithmetic mean of Supporting visitor infrastructure efficiency, Demand driver infrastructure and Overall efficiency scores with ranks for developing countries in 2013-2017.

Country	Supporting visitor infrastructure efficiency		Demand driver infrastructure efficiency		Overall efficiency	
	Score	Rank	Score	Rank	Score	Rank
Argentina	0.358	18	0.239	19	0.286	19
Brazil	0.329	21	0.223	21	0.265	20
Bulgaria	0.484	14	0.385	15	0.428	14
China	1.636	1	0.911	2	1.268	2
Colombia	0.276	23	0.222	22	0.246	22
Croatia	1.004	4	0.517	9	0.715	7
Egypt	0.488	13	0.392	14	0.433	13
Ethiopia	0.348	19	0.181	24	0.237	23
Hungary	0.990	5	0.482	10	0.676	8
India	1.159	3	0.530	7	0.729	5
Indonesia	0.439	16	0.481	11	0.459	12

Continued

Iran	0.482	15	0.278	17	0.353	17
Mexico	0.768	9	0.590	6	0.667	9
Morocco	0.718	11	0.519	8	0.603	10
Peru	0.283	22	0.230	20	0.254	21
Poland	0.972	6	0.637	4	0.779	3
Romania	0.254	24	0.216	23	0.233	24
Russia	0.787	8	0.735	3	0.760	4
South Africa	0.784	9	0.410	13	0.539	11
Sri Lanka	0.701	12	0.251	18	0.405	16
Tunisia	0.335	20	0.332	16	0.334	18
Turkey	1.571	2	1.345	1	1.458	1
Ukraine	0.897	7	0.600	5	0.719	6
Vietnam	0.434	17	0.416	12	0.424	15
Average	0.687		0.463		0.553	

Source: Author's own. Results obtained using the BT DEA Solver Software.

of supporting visitor infrastructure subunit in 2013 and 2015, respectively. India has also maintained its growth in tourist arrivals and international tourism receipts. From 2015 through 2017, India significantly increased its accommodation capacity (UNWTO, 2020). Indeed, the sudden growth in the number of hotel rooms as an input in the supporting visitor infrastructure subunit caused a decline in India's efficiency score in 2017 because it was not compatible with the output growth.

During the studied period, Russia faced a 21% decrease in tourist arrivals and a 26% reduction in tourism inbound receipts (UNWTO, 2020). Due to weak and undeveloped infrastructure and lack of proper development strategies in the tourism sector (Andrades & Dimanche, 2017), this country could not maintain its status in this sector and experienced an efficiency score decline from 2013 through 2017 in both subunits. Considering the descending trend in this period, this country should implement policies to attract foreign investment for improving and developing infrastructure, improve the quality of services offered to the tourists, develop its transportation network, and employ new technologies for constructing accommodation centers (Lavrova & Plotnikov, 2018). Poland has maintained its ascending trend in both demand driver infrastructure efficiency and supporting visitor infrastructure efficiency from 2013 through 2017. Hence, in 2017, this country reached the efficient frontier in the supporting infrastructure subunit. Poland ranked third in overall efficiency over the period 2013-2017. Ukraine ranked fourth in attracting international tourists in 2013 and was efficient in both tourism efficiency subunits. However, in 2015, Ukraine experienced a 48% decrease in tourist arrivals and a 71% reduction in international tourism receipts (UNWTO, 2020) due to Russia's military intervention.

The impacts of this problem are evident in the efficiency scores achieved by Ukraine. The efficiency scores of Mexico's tourism sector show significant growth in both the demand driver infrastructure and supporting infrastructure subunits from 2013 through 2017. According to the available data, about 40 million tourists visited Mexico in 2017, a 38% growth compared to 2013. Hungary in 2015 and 2017 and Croatia in the last year of the studied period demonstrated excellent performance in tourist attraction and income generation from the tourism sector. Both countries achieved an efficient score in the supporting visitor infrastructure subunit over the mentioned years.

Morocco is inefficient in both the demand driver infrastructure and supporting visitor infrastructure subunits. This country should invest in social, transport, and environmental infrastructure, especially ground and air transport infrastructure and accommodation infrastructure, to improve them and provide the basis for attracting more tourists. Bulgaria achieved efficiency scores of 0.484 and 0.385 in the supporting visitor infrastructure and demand driver infrastructure subunits, respectively. This country should renovate its old infrastructure, advertise its tourist attractions, and attract foreign investors to achieve prosperity in the tourism industry (Madanoglu, 2003; Haller, 2016). South Africa achieved an overall efficiency score of 0.539 in the whole study period, and it is ranked 11th among the selected developing countries. Therefore, this country could not use its potential optimally, especially in the demand driver infrastructure subunit. In 2017, Sri Lanka had inefficient performance in the studied period with an overall efficiency score of 0.405. More specifically, this country obtained a low efficiency in the demand driver infrastructure subunit. Therefore, this country should improve its available demand driver infrastructure to attract more tourists and consequently enhance its performance in the tourism sector. Indonesia and Vietnam were inefficient in the whole studied period. However, examining the results shows that these countries have moderate growth in both tourism efficiency subunits.

Over the entire study period, Egypt had inefficient performance and a steady trend in its overall efficiency score. The political crisis in Egypt was one of the important reasons that caused inefficiency in its tourism industry. Tunisia is one of the few countries that experienced an efficiency decline in both tourism efficiency subunits over the studied period. Also, its international tourism receipts at the end of the period were the least among all studied countries. We can investigate one of the important reasons for this descending trend through its infrastructure condition. Tunisia is one of the weakest countries regarding transport infrastructure among the studied countries (WEF, 2019). Also, no development in the infrastructure of this country was seen during the period. Low efficiency in both tourism industry subunits indicates the low productivity of the tourism industry in Iran. This country, with problems like undeveloped infrastructure, extensive boycotts, negative images in the media, and lack of proper management resources in the tourism sector (Khodadadi, 2016), could not achieve a significant share in the global tourism market. Argentina, Brazil, Peru, and Columbia are ranked the 19th, 20th, 21st, and 22nd in overall efficiency, respectively. Despite abundant natural resources, these countries did not reach an acceptable level in the global tourism market. These countries should formulate appropriate policies in their long-term plans to develop their tourism sector and make the best use of their capabilities, especially in the demand driver infrastructure subunit. Ethiopia and Romania had the least efficient tourism industry and are ranked 23rd and 24th, respectively. Moreover, these countries had the lowest tourist arrivals in the whole study period. Poor transport infrastructure and tourism service infrastructure in both countries (WEF, 2019) led to a decline in the performance of these countries in the tourism sector.

4.2. The Impact of Infrastructure on Improving the Tourism Industry in Developing Countries

In both advanced and developing countries, tourism has become an essential factor that is non-separable from their development strategies. Many political and social disorders in developing countries often stem from their weak economy. The accelerated growth of the tourism industry can help bridge the gap between developed and developing countries and guarantee the increasing trend of development in developing countries. Furthermore, this industry significantly affects the economy and social development of developing countries (Elnasr Sobaih & Jones, 2015). Creating job opportunities, developing the infrastructure, increasing the demand for domestic products, increasing the exports, and attracting foreign investment are some capacities of the tourism industry. Therefore, one strategy to achieve economic growth and development in developing countries is the in-depth governmental attention to investment in the tourism industry.

Infrastructure is the main prerequisite for competition in the tourism industry and developing a region at the national and international level (Lim et al., 2019). Global competitiveness in the tourism industry requires a proper and well-equipped infrastructure. Tourism is sensitively affected by the development of infrastructure because the available infrastructure forms the essential part of present tourism destinations that satisfy the requirements of visitors and local people. The lack of infrastructure growth potentially negatively affects tourists' satisfaction and decisions to revisit the tourism destination (Buhalis, 2000). Also, infrastructure is considered one of the main factors for assessing the level of countries' economic development, so that undeveloped infrastructure is a symptom of developing countries (Palei, 2015). This issue is so crucial that access to well-equipped and standard infrastructure is one of the main concerns of most countries. The role of governments and the private sector and their participation in support of infrastructure development in the context of the tourism industry help developing countries compete in global markets. Therefore, investments should be made in the establishment and renovation of infrastructure in order to develop tourism in the future. Furthermore, the development of the tourism industry in developing countries requires meticulous planning. Tourism policy-making should lead to increased public cooperation in the development trend and continuous appraisal of the compatibility between tourism development and the infrastructure resulting from implementing the policies.

4.3. Infrastructure Development in Developing Countries

As noted before, infrastructure is an important measurement factor representing the economic development level of countries. Furthermore, infrastructure has multiple applications and is considered the driving factor for many profitable activities in a country. Thus, lack of appropriate infrastructure prevents the development of countries. Accordingly, investing in infrastructure development is one way to increase a nation's economic development pace and life quality. Since in most developing countries, there is a lack of infrastructure or the infrastructure is mostly in an unfavorable condition (WEF, 2019), it can be concluded that achieving a desirable level of infrastructure should be given special priority in development plans and public policies. Because infrastructure development is costly and time-consuming, most governments of developing countries cannot handle it alone. Therefore, developing countries should seek help from organizations that work globally to facilitate infrastructure development by loaning and providing support measures. For example, Japan and South Korea improved their infrastructure; to do so, they received huge loans from these organizations to realize many of their objectives in this area (Kim, 2006).

On the one hand, infrastructure deeply impacts the development of the tourism industry in developing countries. On the other hand, these countries can use the tourism industry, which has the ability to bring significant foreign exchange and inject income into the countries' economy, as a driving force to provide part of the national budget for infrastructure development. As mentioned before, infrastructure development is time-consuming, so developing countries should not wait for the completion of their tourism infrastructure since they can simultaneously develop their tourism infrastructure and advertise their tourist destinations purposefully and extensively to attract tourists.

Investment in infrastructure development is vital for the tourism sector. Since constructing infrastructure from the beginning to the end requires high cost, multiple sources are usually utilized to supply capital for these projects. Therefore, in addition to government funding, the cooperation of the private sector can also be involved. Since the governments have expenses other than constructing and operating the infrastructure, the government's financing alone is insufficient. Therefore, the government should take the initial steps and provide maximum assurance to the private sector that they will not only avoid losses but will make profits. In this way, the private sector can be encouraged to work either along with the government or separately to achieve infrastructure development.

In summary, having the highest number of WHSs and abundant tourist attractions, the selected developing countries mostly have low efficiency in the tourism industry. One of the main reasons for the inefficient performance of these countries is the lack of well-equipped and standard infrastructure. In most developing countries, the main obstacles preventing tourism infrastructure development are political turmoil, negative information streams in media, and delays in projects due to excess paperwork, all of which lead to the unwillingness of foreign investors to invest in the tourism sector. As most developing countries are willing to develop their tourism industry, constructing the required infrastructure should become an obligation and necessity in these countries. When infrastructure construction and development in a country is started, economic development is also started.

5. Conclusion

Using a performance measurement framework based on a two-stage super-efficiency SBM model, we evaluate the tourism industry efficiency in 24 developing countries in the context of infrastructure. This study used the data from 24 developing countries for the years 2013, 2015, and 2017. None of the previous studies considered social, transport, and environmental infrastructure simultaneously. Therefore, the novelty of this study is the selection of developing countries on a global scale considering the three mentioned fundamental tourism infrastructures. Considering the most effective infrastructure for the tourism industry performance, this study divided the overall tourism efficiency of the selected countries into the subunits of demand driver infrastructure and supporting visitor infrastructure. Thus, the proposed model detected the causes of inefficiency in the selected countries more thoroughly and accurately. This article is a comprehensive effort to obtain an accurate insight into the relationship between infrastructure condition and the tourism sector.

The results showed that China and Turkey achieved overall efficiency scores greater than 1 in the entire period. Furthermore, most selected countries have achieved low overall efficiency scores in the tourism sector and could not attain the desired output level relative to their resources. The average efficiency scores of the demand driver infrastructure subunit and supporting visitor infrastructure subunit for the selected countries are 0.463 and 0.687, respectively. Besides, the average overall efficiency of selected countries is 0.553. These results indicate that the inefficiency of these countries results from a lack of infrastructure, undeveloped infrastructure, and lack of appropriate strategies for creating and improving them in the tourism industry.

The current study investigated the effect of infrastructure on improving the tourism industry. It was shown that lack of infrastructure, facilities which form a driving force of countries' most profitable activities, prevents tourism development. Also, the results showed that the infrastructure forms an essential part of the current tourism destinations, and the existence of undeveloped infrastructure negatively affects the tourists' satisfaction and their decision to repeat their trip to destinations. Therefore, well-equipped infrastructure is a fundamental prerequisite for tourism competitiveness globally. In addition, to achieve tourism development, investments must be made to create and improve infrastructure, with the participation of the government and the private sector to finance it. It was also mentioned that although development and renovation of infrastructure are time-consuming, developing countries do not need to wait for the completion of their infrastructure; they can simultaneously develop their infrastructure and attract international tourists through effective and purposeful advertisement.

To sum up, the developing countries should consider long-term plans and required policies to develop the infrastructure and monitor the tourism growth compatibility with the infrastructure resulting from the implementation of these policies. As a result, they can use their tourism resource capacities to attract tourists and income, and finally, achieve economic prosperity and social welfare.

Future studies can use different inputs and outputs to attain the perfect combination of them, possibly resulting in a more comprehensive efficiency evaluation framework for the tourism industry. Also, subject to data availability, a larger dataset and more decision-making units could be incorporated to obtain a more accurate and comprehensive analysis.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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