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Efficiency Evaluation in the Tourism Sector in Croatia and Serbia: Applications of Data Envelopment Analysis

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Abstract: *Tourism is one of the most contributing economic sectors globally and is especially important for developing economies, due to its contribution to GDP, creation of new jobs and its impact on economic development. The tourism sector has gained a lot of attention from academia and governments due to its strategic position in the economy. Its efficiency and performance are closely researched and analysed. One of the leading non-parametric methodologies that have been often used to evaluate relative efficiency of homogeneous entities is the Data Envelopment Analysis (DEA).*

The main goal of this chapter is to identify, present and explore the applications of DEA in different aspects of Croatian and Serbian tourism. Other goals are to present and analyse the findings of the twelve surveyed papers and to highlight the benefits and limitations of the DEA methodology. Additionally, this research represents an incentive and an inspiration to other academic members and researchers to apply the DEA methodology in their future studies when analysing and investigating efficiency in the tourism sector, as well as any other economic sector.

1. INTRODUCTION

Tourism is one of the largest and most important economic sectors, due to its contribution to GDP, rate of employment, exports and, therefore, economic development and growth. It is "an important mechanism of economic development and an important generator of new working posts in many countries". Furthermore, it has always been an area of great interest for governments of developing countries in their efforts to increase the economic benefit from tourism development" (Banožić et al., 2015).

As Cvetkoska & Barišić (2014) state, "tourism, in general, interferes in almost all spheres of social and economic development". Notwithstanding, it is "one of the most dynamic and complex activities among contemporary socio-economic phenomena" (Hodžić, Bogdan & Bareša, 2020) that impacts the socio-economic development and "the long-term economic growth through different channels, such as currency flow, infrastructure investment, stimulation of other sectors and income generating" (Schubert et al., 2011; Pavković et al., 2021). Therefore, it is undeniable that tourism is strategically important for the developing countries' economies especially considering its characterization as a continuously growing and developing industry in the last two decades (Prorok et al., 2019).

Global tourism represents "around 10% of the world's economic activity" (Radovanov et al., 2020), "7% of the global trade, and 1 in 10 jobs" (Barišić & Cvetkoska, 2020). It is expected „to grow along with the world's prosperity and well-being, but will be strongly influenced by contemporary trends such as socio-demographic trends; economic trends expressed through

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declining poverty and a growing middle class; technological revolution and evolution; digitalization of tourism; health and healthy lifestyle; political tensions; security; threats of terrorism, etc." (Nakovski et al., 2021).

One of the most important principles in any business is the principle of efficiency, which consists in achieving the most economic effects (outputs) with as little as possible economic sacrifices (inputs). Efficiency can also be defined as the ability to achieve goals with the minimal use of available resources. Efficiency represents one of the most crucial principles in organisations' operations and one of „the most important indicators for the successful operation" (Cvetkoska & Fotova Čiković, 2021; Cvetkoska, 2011) which "refers to the relationship between the input and the output, i.e., using the minimum resources (human, organizational, financial, material, physical) to produce the desired production volume" (Cvetkoska & Barišić, 2020). In this context, if the level of output has increased with the same level of input, or the level of output has remained unchanged, but the level of used inputs has decreased – this means the efficiency has increased. According to Greene (1993), "the empirical estimation of the extent to which observed agents achieve the theoretical ideal" represents the measurement of efficiency. One of the leading nonparametric methodologies - the DEA methodology has been one of the most applied approaches when analysing relative efficiencies. The main goal of this chapter is to present this methodology and to present its applications in the investigation of efficiency in the Croatian and Serbian tourism sectors.

This chapter consists of 6 sections. After the first section (Introduction), a theoretical overview of the DEA methodology has been presented. The third and the fourth section provide a background on the Croatian and Serbian tourism sectors, respectively. The fifth section presents the surveyed studies on tourism that employ the DEA methodology regarding the Croatian and Serbian tourism and the last, sixth section opens up a discussion and concludes this chapter.

2. DATA ENVELOPMENT ANALYSIS: THEORETICAL BACKGROUND AND BASIC MODELS

There are three approaches to evaluating efficiency in the literature: the ratio indicators, the parametric and the nonparametric methods. The ratio indicators are the simplest approach and their limitation is they „cannot influence overall corporate efficiency" (Micajkova & Poposka, 2013). The parametric methods of efficiency evaluation include the factor analysis, regression analysis, and stochastic frontier approach, which are employed for evaluation of the economic efficiency. And then there are the nonparametric methods, which include the Data Envelopment Analysis (DEA) and the Free Disposal Hull (FDH) (Vincova, 2005; Soysal-Kurt, 2017).

DEA is a primarily „data-oriented" approach that uses the conversion of multiple input variables to multiple output variables for the evaluation of the DMUs (Cvetkoska, 2011). As a nonparametric methodology, it focuses on the extreme observations, whereas the parametric methods „focus on average tendencies and deviations from it" and they can employ only one output, which is one of their biggest limitations (Cvetkoska & Fotova Čiković, 2021).

DEA has been introduced by Charnes, Cooper & Rhodes in 1978 but its origins date to Farell (1957), who introduced the concept and measurements of technical efficiency. The two basic DEA models are the CCR and the BCC model. The main distinction between these models is the built-in assumption regarding the return to scale. The CCR model (originally named in

honour of the founders Charnes, Cooper and Rhodes) assumes a constant return to scale (CRS), i.e. „the output variables increase proportionally with input variables" (Cooper et al., 2006), while the BCC model (which estimates the pure technical efficiency of the analysed DMUs) is based on the assumption of the variable return to scale (VRS), i.e. the increase in input variables does not lead to a change in the output variables in the same proportion. The CCR model is graphically represented as a straight line, whereas the BCC model is represented by a convex hull (Hodžić & Jurlina Alibegović, 2019).

Furthermore, there are two DEA orientations, namely the input-orientation and the output-orientation. The input-oriented DEA model assumes „minimization of inputs for the given level of output, whereas the output-oriented DEA model supposes maximization of outputs for the given inputs" (Poldrugovac et al., 2016).

Interestingly, DEA has been originally designed to evaluate the efficiency of the non-profit sector (Barišić & Cvetkoska, 2020), but it soon spread to many other sectors and is today successfully implemented in many various sectors, such as banking (Micajkova & Poposka, 2013; Fotova Čiković & Cvetkoska, 2017), forestry (Šporčić et al., 2008), education (Obadić et al., 2011; Mihaljević Kosor et al., 2019), the health sector (Pereira et al., 2021), the public sector (Rabar et al., 2021) to measuring the efficiency of football clubs (Guzmán-Raja et al., 2021) and restaurants (Planinc et al., 2019).

In this chapter, the applications of DEA in the tourism sector in two developing countries (i.e. Croatia and Serbia) will be elaborated.

3. BACKGROUND AND PERSPECTIVES OF THE CROATIAN TOURISM SECTOR

Tourism occurred in Croatia in the 19th century, and ever since, it has been the main driver of Croatian economic development. Tourism affects the gross national product, level of employment and the balance of payment (Baldigara et al., 2012). This should come as no surprise, considering that Croatia has been pinpointed „as an ecological treasure of Europe, with 47% of its land and 39% of its sea designated as specially protected areas and areas of conservation" (Gržinić, 2017). Banožić et al. (2015) state that "the clean sea, the coast, and the abundance of natural and cultural beauty are the advantages of Croatia's tourism supply in the maritime part of the country".

Croatian tourism is characterized by a high seasonality (during the summer season), dense concentration and development along the seaside and in the island regions (except for the capital city Zagreb) and high dependency on the interconnectedness of the islands and the mainland (Šimundić et al., 2021; Dujmović et al., 2020).

In 2018, Croatian tourism had a share of 2.1% of total tourist flows in the European Union and almost 20% of the total Croatian GDP (Šverko Grdić et al., 2019; Orsini et al., 2019). Tourism generates 24% of total employment in Croatia, i.e. 92,000 people in 2019 (Škrinjarić, 2018; Rašić, 2019). It is, therefore, no secret that Croatia is highly dependent on the tourism industry and that tourism is one of the "leading sectors of the Croatian economy" (Banožić et al., 2015). It has been proven that „the tourism-led growth hypothesis is valid for Croatia" and that it has been a major factor in the overall long-run economic growth of the country (Svilokos et al., 2014; Perić et al., 2016).

The ongoing COVID-19 pandemic has imposed travel restrictions that impacted various sectors of the economy but mostly affected the tourism sector since it is almost completely „dependant on the transport and hospitality sectors, both of which were among the first to be affected by the corona crisis" (Šimović et al., 2021). UNWTO (2020) states that tourism should be the main recovery sector and that it can „play the key role in future recovery efforts". They define tourism as a „firmly established important contributor to sustainable development, economic growth, employment and international understanding".

The news from the Croatian National Tourist Board (2021), however, seems promising. In July 2021, there were 3.7 million tourist arrivals and 25 million overnight stays (out of which 21.6 million were generated by foreign tourists). These results show a rise in the number of arrivals in comparison with 2020 by 47 per cent and a rise in the overnight stays by 33 per cent. Croatia, with its long tourist tradition and excellent possibilities for further growth, and as one of the most important tourist destinations in the Mediterranean, could use the lessons learned from the pandemic to transform its aspiration for growth and promote sustainability in tourism (Baldigara et al., 2012; Harchandani et al., 2021). There are many case studies of certain destinations that offer and develop sustainable tourism in the long run in Croatia. They also open discussion on sustainability, and sustainable tourism growth as well as environmental conscious tourism in Croatia (Škrinjarić, 2018).

Nevertheless, Šimundić & Kordić (2021) state that the great share of the tourism sector in Croatian's GDP „implies overreliance on tourism exercised by the country as a whole". Šimović et al. (2021) additionally warn about the unsustainability of the current Croatian economic model. They also highlight the necessity to minimize the dependency of the Croatian economy on tourism, due to climatic, socio-political and other reasons. They claim that the ongoing COVID-19 pandemic has additionally shown the „urgent and fundamental" need to change the economic model, since it has affected the rates of unemployment, but also impacted the decline in the turnover of many tourism-related activities, such as „agriculture, winemaking, fishing, food and the beverage industry, as well as catering, entertainment, the music industry, and others". The overreliance of Croatia on tourism should gradually decline and its sustainable development and growth should focus on „new technologies, software production, creative industries with high added value, energetics and knowledge and creative economy in general" (Dujmović et al., 2020). They (Dujmović et al., 2020) also add that tourism is a low-profit industry for the developing and underdeveloped countries and „it takes longer to obtain a return from an investment into the tourism industry and brings less added value". In their paper, they continue to express their concern that tourism is not enough for Croatia's development and growth and that Croatia should not build its competitiveness solely on tourism. They go one step further and claim that Croatia should reduce the share of tourism in GDP below 5 per cent if it wants to become an economically developed country and that tourism should be a secondary activity (in their words: „the cherry on top of the cake") and not one of the main economic activities, which is an interesting opinion to ponder over.

4. BACKGROUND AND PERSPECTIVES OF THE SERBIAN TOURISM SECTOR

The tourism industry in Serbia in 2017 had a share of 0.9% of GDP. Its direct contribution to employment was 32 000 jobs, representing 1.8% of the country's total employment. However, it is considered that tourism's "total contribution to the Serbian economy, including the effects from investment, supply chain and induced income impacts, amounted to RSD 294.6 billion in 2017,

or 6.7% of GDP" (OECD, 2020). Some major changes in this sector have appeared in 2014, with the Government's development and introduction of measures in four tourism-strategic regions, which affected the tourism sector positively, and reflected in the rise of its share in Serbian's GDP. In 2019, before the COVID-19 pandemic, the tourism statistics were hopeful: Serbia had noted an increase in total arrivals and the number of overnight stays by 7%. However, the COVID-19 pandemic in 2020 had a severe impact on this sector. Namely, even though the Serbian Government has undertaken and implemented many preventative measures in order to protect this sector, its recovery will probably last „at least two to four years" (China CEE Institute, 2020).

Even though Serbia has a favourable geographical position on the Balkan peninsula and a beautiful landscape, „the market potentials of its tourism industry have never been fully realized". The reasons behind it were mostly due to the country's questionable reputation during the 1990s and its financial crisis in 2009 (China CEE Institute, 2020). These factors affected the slow growth of the tourism industry in Serbia. Bogetić et al. (2020) have highlighted the „insufficient offer and unattractiveness of tourism offers" as the crucial problem and issue in Serbian tourism. Radović (2016) on the other hand, suggests that Serbia should follow Slovenia's example and footsteps in the development of rural tourism, which appears to be very successful in Slovenia. Furthermore, rural tourism has been stated as a special priority in National Sustainable Development Strategy in Serbia since 2007 and it enjoys a status of a „high potential sector with the vertical institutional structure supporting its development" (Petrović et al., 2017).

This viewpoint is following the state's measures for sustainable tourism development, which include „increasing levels of environmental consciousness, growing the interest in heritage and culture, strengthening local economic activity, as well as supporting the development of visitor activities that enable visitors to meet residents and engage in cultural tourism activities and events" (OECD, 2020).

5. APPLICATION OF DEA IN EFFICIENCY EVALUATION OF THE TOURISM SECTOR IN CROATIA AND SERBIA

DEA is the leading nonparametric methodology that is used to evaluate efficiency in different industries. The main focus of this chapter is to survey, present and analyse the different applications of DEA in Croatian and Serbian tourism.

The authors have surveyed all the studies and papers that have investigated the efficiency of any aspect of the tourism sector in both analysed countries, searching both Scopus and Web of Science databases. However, some of the presented studies have not been published in papers indexed in the above-mentioned databases, but their findings are crucial to the completeness of this chapter. Therefore, a short presentation and analysis of the surveyed (12 in total) papers are given as follows.

Rabar & Blažević (2011) have employed both the CCR and BCC output-oriented DEA model to evaluate the touristic efficiency of Croatian counties in 2008. Notwithstanding, they have employed the window analysis DEA model for the period 2004 – 2008. Their goal was to identify the efficient counties which would represent a benchmark and to identify the inefficient counties in order to suggest appropriate measures. In their study, they used three inputs (number of beds, number of seats and number of employees) and three outputs (number of arrivals, number of stays, number of nights, revenue in thousands of kuna - HRK). The results of the BCC DEA model show

13 efficient and 8 inefficient counties, whereas the CCR model shows 10 efficient and 11 inefficient counties in 2008. The average efficiency score in the CCR model was 0.910 and 0.964 in the BCC model. Since in the BCC model, the number of efficient counties is 30 per cent higher than the results according to the CCR model, Rabar & Blažević (2011) decided to go forward with their research with the BCC output model only, because „it is more appropriate since it is most likely an effect of the scope of action". The results of their DEA window analysis, on the other hand, show that Istria County has been the most efficient county in 2008. However, no county has been efficient in the whole period of five years. Two counties have been efficient in four years, while four counties have noted efficiencies in one, two or three years. A staggering number of 7 counties was inefficient in the whole observed period of 5 years.

Table 1. The DEA applications regarding the Croatian and Serbian tourism

Author/s and year of publication	Application	Time frame	Analysed countries	Applied DEA model
Rabar & Blažević (2011)	Evaluation of the tourism efficiency of Croatian counties	2008 2004-2008	Croatia (i.e. Croatian counties)	Output-oriented BCC and CCR DEA model
Cvetkoska & Barišić (2014)	Measuring the efficiency of 15 European countries in tourism	2004-2013	15 European countries (CRO + SRB)	DEA window analysis model
Cvetkoska & Barišić (2017)	Measuring the efficiency of the tourism industry in the Balkans	2010-2015	11 Balkan countries (CRO + SRB)	DEA window analysis model with the VRS
Soysal-Kurt (2017)	Measuring tourism efficiency of 29 European countries	2013	29 European countries (CRO)	Input-oriented CCR DEA model, with three inputs and three outputs
Ilić & Petrevska (2018)	Determination of tourism efficiency of Serbia and the surrounding countries	2016	15 Balkan and Southeast European countries (CRO+SRB)	Input-oriented CCR DEA model with CRS assumption
Škrinjarić (2018)	Assessment of the efficiency of environmentally conscious tourism industry	2011-2015	Croatia (i.e. of 21 Croatian counties)	Output oriented DEA model with VRS
Prorok, Šerić & Peronja (2019)	Analysis of overall and pure technical efficiency of tourism in Europe	2017	EU and non-EU countries, including Croatia and Serbia	Output-oriented CCR and BCC DEA model
Barišić & Cvetkoska (2020)	Analysing the Efficiency of Travel and Tourism in the European Union	2017	28 EU member countries (CRO)	Output-oriented BCC DEA model
Galic, Arifhodzic, Satrovic, Dalwai & Milicevic (2020)	Measuring tourism efficiency of NUTS II area of the Adriatic-Ionian region	2011-2014	41 regions in the Adriatic-Ionian region (CRO + SRB)	Input-oriented BCC DEA model + Malmquist method
Marcikić Horvat & Radovanov (2020)	Efficiency of tourism development	2013-2019	33 European countries (CRO + SRB)	Application of output-oriented BCC DEA model and TOBIT model
Radovanov, Dudic, Gregus, Marcikic Horvat & Karovic (2020)	Measuring tourism potentials of EU and Western Balkan countries	2011-2017	27 EU countries and 5 Western Balkan countries (CRO + SRB)	A Two-Stage DEA Model (output-oriented DEA + Tobit regression model)
Pavković, Jević, Jević, Nguyen & Sava (2021)	Determining Efficiency of Tourism Sector	2017	23 European countries (CRO + SRB)	BCC and CCR DEA model

Source: Authors

Cvetkoska & Barišić (2014) have employed the Window analysis technique to evaluate the efficiency of fifteen European countries (Austria, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, France, Greece, Italy, Macedonia, Montenegro, Portugal, Serbia, Slovenia and Spain) in tourism. The observed period is 10 years (from 2004 to 2013). They selected

two inputs (visitor exports and domestic travel and tourism spending) and two outputs (travel and tourism total contribution to GDP and travel and tourism total contribution to employment) for their DEA model. Their obtained results show no country from the sample to be relatively efficient every year in every window. The year with the highest efficiency results is 2004 and 2011 is the year with the lowest efficiency results. In terms of overall efficiency by years, they found 10 out of 15 countries to note an efficiency higher than 95%. They also found Montenegro to be the least efficient country, whereas Italy, Cyprus, France and Spain are the most efficient countries in their sample.

Cvetkoska & Barišić (2017) have focused on investigating the efficiency of the tourist industries of eleven Balkan countries (namely Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Macedonia, Montenegro, Romania, Serbia, Slovenia, and Turkey) in the period of six years (2010-2015). They have implemented a DEA window analysis model with the variable returns to scale (VRS) assumption. Their model used two inputs (Visitor exports and Domestic travel and tourism spending) and two outputs (Travel and tourism total contribution to GDP and Employment). Their findings suggest that no country from the sample was efficient every year in every window. However, Albania, Croatia, Romania, and Turkey are found to be „most efficient countries in tourism". Furthermore, they found that „the most efficient country in the whole observed period is Albania, while the least efficient country is Montenegro". The lowest efficiencies in tourism were also noted for Serbia and Bosnia and Herzegovina. The average score of efficiency of the tourism industries in the whole sample is 0.9342. 2013 was the year with the highest, whereas 2011 was the year with the lowest efficiency. These results are consistent with the previous study by Cvetkoska & Barišić (2014).

Soysal-Kurt (2017) has investigated the tourism efficiency of 29 European countries by implementing the input-oriented and constant returns to scale DEA model for the year 2013. In his DEA model, he has selected tourism expenses, the number of employees and the number of beds as input variables, whereas tourism receipts, tourist arrivals and the number of nights spent are selected as output variables, i.e. three inputs and three outputs. His findings show that 16 out of 29 analysed countries are relatively efficient, while 13 countries are relatively inefficient. In this research, Croatia is one of the efficient countries with a relative efficiency score of 1, whereas Serbia has not been analysed.

Ilić & Petrevska (2018) have applied the DEA methodology to evaluate the tourism efficiency of Serbia and its surrounding countries (i.e. a total of 15 countries). In their study, tourism expenses and the number of beds are selected as input variables, whereas the number of arrivals and the number of nights spent and tourism revenue are selected as output variables. They analyse the year 2016. Their findings show that six countries are relatively efficient, while nine countries are relatively inefficient. The results also indicate that Croatia is relatively efficient in 2016, while Serbia has noted an efficiency result of 64.49%.

Škrinjarić (2018) has applied the DEA methodology to empirically assess the efficiency of the environmentally-conscious tourism industry of 21 Croatian counties in the period from 2011 to 2015. This study is revolutionary since it combines both economic and environmental variables in the total efficiency evaluation of the tourism industry as a sustainable business. The DEA model included number of beds, number of rooms, municipal waste in tourism (in tons), current expenditures on environment protection (in thousands of HRK), total investments on environment protection (in thousands of HRK), number of tourist arrivals, number of overnight

stays, total GDP (in thousands of HRK) and the surface of each county (in square kilometres), tourism pressure, reciprocal value of municipal waste, percentage of current expenditures, percentage of total investments in GDP and undesirable output municipal waste that were used as variables in the model. In her study, Škrinjarić (2018) has developed four DEA models in order to assess the efficiency of the Croatian counties concerning environmental consciousness. Her findings suggest that tourist arrivals in all Croatian counties are satisfactory but changes regarding the expenditures on environmental protection are needed for all the counties to become relatively efficient.

Prorok, Šerić & Peronjac (2019) have applied the DEA methodology to examine the efficiency of tourism in two groups of countries (EU and non-EU countries) in 2017. In their model, they have grouped the countries (i.e. the sample) in clusters of countries for more individual and detailed approach and analysis and in order „to form relatively homogeneous decision-making units that have similar or identical tourism potentials". Thus, the selection of inputs has been conducted with the help of the principal component analysis method and every group (cluster) of countries had its own set of two input and two output variables. The results from this study show that Croatia (which was in the EU-countries group) has been relatively efficient in 2017 according to the BCC model, whereas the CCR model showed an efficiency score of 92,25%. Serbia, on the other hand, (together with Bosnia and Herzegovina and North Macedonia) has achieved „lower coefficient of total technical efficiency, while their coefficient of pure technical efficiency was one". These findings imply that Serbia is ineffective in terms of scale, „possibly as a result of the non-existence or inefficient implementation of operational activities in the field of tourism, as well as of unfavourable conditions for its development".

Radovanov, Dudic, Gregus, Marcikic Horvat & Karovic (2020) have investigated the tourism efficiency of 27 EU countries and five Western Balkan countries in the period from 2011 to 2017, employing a two-stage output-oriented DEA in combination with the Tobit regression model. They selected one input (T&T government expenditure, as a percentage of the total government budget) and three outputs (Average receipts per arrival, T&T industry employment - as a percentage of total employment and Sustainability of travel and tourism industry development,) in their DEA model. The results from the first stage of the DEA model show very high efficiency in the case of 15 EU countries, as well as a high-efficiency score of 1 for both Serbia and Croatia. The second stage of the model indicates that „sustainability of tourism development, the share of GDP, tourist arrivals and inbound receipts, as well as visa requirements and rate of use" have all a very significant effect on relative tourism efficiency.

Galic, Arifhodzic, Satrovic, Dalwai & Milicevic (2020) have employed the BCC output-oriented model to evaluate the tourism efficiency of 41 NUTS (Nomenclature of Territorial Units for Statistics) II area Adriatic-Ionian Region in the period from 2011 to 2014. In their model, they use three inputs (number of persons employed, number of bed-places, arrivals) and two outputs (gross domestic product, nights spent). Their findings indicate that eleven NUTS areas, out of 41, are efficient. Adriatic Croatia has been one of the most efficient units (NUTS areas) with an efficiency score of 0.946547 in 2011 and a relative efficiency score of 1 in three consecutive years (2012-2014). Southern and Eastern Serbia has also noted three consecutive years of relative efficiency (2011-2013) and lowered its efficiency in 2014 (0.3301). Province of Vojvodina and Sumadija and Western Serbia have both experienced relative efficiencies in two consecutive years (2011-2012) and thereafter lowered their efficiencies. Continental Croatia is the only area that has not noted a relative efficiency result of 1 and notes an average efficiency score

of 15.86%. These findings are scientifically contributing to regional governments, policy-makers, academia and the interested public since this is the first efficiency measurement study with DEA using the 41 NUTS II area for the Adriatic-Ionian Region.

Barišić & Cvetkoska (2020) have concluded a cross-country study where they focused on the efficiency of travel and tourism impact on the GDP and employment in all the 28 EU-member states in 2017. Their output-oriented BCC DEA model used two inputs and two outputs (Internal travel and tourism consumption and capital investment as inputs, while travel and tourism's total contribution to GDP and employment as outputs). The results of their study show 13 (Bulgaria, Cyprus, Estonia, Germany, Greece, Hungary, Italy, Latvia, Malta, Portugal, Romania, Spain, and the United Kingdom) out of 28 EU countries to be relatively efficient in 2017 and 15 were not. The average efficiency of the whole sample is 0.9441, with maximum efficiency of 1, and a minimum of 0.7406. They have even gone one step further and have ranked each EU country (a rank of 1 for the efficient countries and a rank from 14 to 28 for the relatively inefficient EU countries). The scientific and practical contribution of this study is mirrored in the reference set for the inefficient countries that indicate „what changes should be made by relatively inefficient states, or more precisely how much they should increase the outputs to become relatively efficient".

Marcikić Horvat & Radovanov (2020) have investigated the tourism efficiency of 33 European countries using a two-stage DEA model for the period from 2013 to 2019. Their developed output-oriented DEA model has selected one input (i.e. government expenditure for travel and tourism – T&T) and four outputs (average receipts per arrival, number of international tourist arrivals, T&T share of GDP and T&T share of employment). Their findings show that Serbia (as a part of the group of Western Balkan countries) has noted „the maximal level of efficiency during the whole 6-year period", whereas Croatia (as a part of the group of New EU member states), had „obtained significantly higher efficiency scores than other countries", i.e. both Serbia and Croatia noted a relative efficiency result of 100%. Furthermore, the highest average efficiency score was achieved by the EU15 group countries.

Pavković, Jević, Jević, Nguyen & Sava (2021) have developed a DEA model including three inputs (number of hotels and similar accommodation capacities, number of rooms, number of bed places) and three outputs (number of inbound tourists, number of bed-nights and tourism expenditure in dollars). The analysed sample incorporates 23 European countries, which were systemized into five groups as follows countries in transition (Serbia, Croatia, North Macedonia, Montenegro, Romania), Scandinavian countries (Sweden, Norway, Denmark), Eastern European countries (Hungary, Poland, Czechia), Mediterranean countries (France, Greece, Cyprus, Malta, Italy, Portugal, Spain) and Central and Western European countries (Slovenia, Austria, Belgium, Germany, the Netherlands). Their study reveals insightful information regarding the efficiency of the countries in transition, which are our subject of interest. Namely, Croatia is the only country that appears relatively efficient, whereas all the other countries in this group show high inefficiency. Furthermore, Serbia is the least efficient country in tourism, with an efficiency score of 20.94%. These authors have even gone a step further and have provided targets for improvement for Serbia to reach efficiency. Regarding the whole sample of 23 DMUs, only three countries appear relatively efficient and these are Croatia, Belgium and Denmark.

There are other articles regarding the efficiency of Croatian and/or Serbian tourism, but they have applied different methodologies. For example, Janković & Poldrugovac (2015) have used

benchmarking in order to compare the results of Croatian and Slovenian hotels. Kovačić, Topolšek & Dragan (2015) have implemented the SEM (Structural Equation Modeling) to analyse the tourism sector, travel agencies, and transport suppliers and Šimundić & Kordić (2021) have evaluated the efficiency of seaport authorities in Croatia using the output-oriented CCR model and output-oriented BCC model to identify the technical (TE), scale (SE) and overall technical efficiency (OTE). Perić & Nikšić Radić (2016) have investigated the causal relationship between the foreign direct and the number of international tourist arrivals in Croatia in the period from 2000 to 2012, implementing the ADF Test and the Johansen co-integration, Granger causality test and the Toda–Yamamoto test. Their findings imply that FDI in tourism has a causal relationship with the arrivals of tourists from abroad.

6. DISCUSSION AND CONCLUSION

In this chapter, a pragmatic perspective has been adopted and an objective presentation of both the upsides and downsides of the DEA methodology has been laid out as follows.

There are many discussions and open criticism regarding the limitations of the DEA methodology „on a number of methodological and substantive grounds regarding the DEA methodology" (Fotova Čiković & Lozić, 2022). First of all, DEA does not estimate the absolute, but the relative efficiency of each DMU. Secondly, results could be biased if heterogeneous inputs and/or outputs are considered to be homogenous. Third, the efficiency results „could be influenced by outliers". There is also the possibility that the comparison of the efficiency scores of the two samples could be useless. Furthermore, the fact that the standard DEA does not take into account the multi-period optimisation and the risk in the management decision-making process is a great limitation of this methodology (Hodžić, Bogdan & Bareša, 2020). Fotova Čiković & Lozić (2022) state the following limitations of DEA: the basic assumption that random errors do not exist can lead to frontier sensitivity to extreme observations and measurement errors; the ignoration of the impact of the exogenous variables; the lack of offered possibilities for the performance and efficiency improvement; challenges in the performance of additional statistical tests and sensitivity of the results to the selection of the used variables.

On the other hand, DEA has a handful of advantages when compared to conventional accounting methods. In this context, DEA makes it possible to give a comparison of the relative performance between multiple performance measures (Poldrugovac et al, 2016) and is commonly employed in benchmarking and obtaining guidelines for improvements in business performance and efficiency (Jardas Antonić & Pavlić Skender, 2015). Furthermore, DEA has a very practical component that allows for the identification of the best-practice DMUs that serve as benchmarks for the inefficient DMUs and does not depend upon a subjective opinion of researchers, which lowers the negative effect of various biases and mistakes (Hodžić, Bogdan & Bareša, 2020).

When compared to the parametric methodologies (i.e. regression in particular), there are many benefits to using the nonparametric methodologies. For example, the parametric methodologies obtain information regarding the average performance of the analysed entity and focus on average tendencies and deviations from it, whereas the non-parametric methods observe extreme observations. Another advantage of this methodology is there is no requirement for assessment or a priori knowledge of the weights of the inputs and outputs. The most important advantage when employing this methodology is „the possibility to include more than one output and to not set assumption for the production function" (Cvetkoska & Fotova Čiković, 2021).

Furthermore, the advantage of efficiency information provided by DEA is that all the inputs and outputs of a business are taken into consideration and it provides a wider perspective of the performance (Poldrugovac et al, 2016). Additionally, DEA does not require functional dependence between input and output variables when solving fragmented linear programming and calculates the relative efficiency of decision-making units using multiple inputs and outputs not necessarily expressed in identical measurement units (cost, number of employees, etc.) (Jardas Antonić & Pavlić Skender, 2015; Hodžić, Bogdan & Bareša, 2020).

Even though there are some limitations and setbacks to this methodology, its upsides are outweighing them by far. Stolp (1990) refers to both the upsides and downsides of DEA and points out the informativeness and usefulness of DEA as a tool for systematic sensitivity analysis.

The findings of the extensive literature review show that most of the twelve surveyed papers have applied the output-oriented DEA model (7 out of 12), two papers have applied the window DEA model and three papers have applied the input-oriented model. Most of these studies have been conducted for the period after 2010 and have applied the BCC DEA model (5 papers). Three studies have implemented both the CCR and BCC DEA models, whereas two papers have implemented the CCR DEA model. Two of the surveyed papers are analysing solely the Croatian tourism, while the rest (10 papers) are cross-country studies, mostly analysing the EU-member countries and the Western Balkan countries.

This paper represents an incentive to other scholars and academic members to implement and employ the leading nonparametric DEA methodology in their future research regarding the tourism sector. Notwithstanding, the presented studies and their invaluable findings provide new insights for the academia, the interested public and the government.

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