Hotel Efficiency Measurement in The Most Economically Sustainable Regions by Using Data Envelopment Analysis (DEA)

Sina Vahedi

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Approval of the Institute of Graduate Studies and Research

Prof. Dr. Ali Hakan Ulusoy
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Science in Tourism Management.

Prof. Dr. Hasan Kılıç
Dean, Faculty of Tourism

We certify that we have read this thesis and that in our opinion it is fully adequate in scope and quality as a thesis for the degree of Master of Science in Tourism Management.

Assoc. Prof. Dr. Mine Haktanır
Supervisor

Examining Committee

1. Prof. Dr. Ali Öztüren

2. Assoc. Prof. Dr. Mine Haktanır

3. Assoc. Prof. Dr. Hale Özdoğaç Özgit

ABSTRACT

In the past decade, sustainability trend has been increasingly applied by most of the countries around the world. As a result, all countries in the United Nations have decided to formulate sustainability into a framework by introducing sustainable development goals (SDG) in 2015. SDG consists of 17 goals to cover all the aspects of the sustainability such as environmental, social and economic sustainability. These goals are not only a great instruction for countries to apply sustainability, also it can help countries to evaluate and estimate their successfulness of sustainability in different organizations and businesses. SDG 8 (decent work and economic growth) as one of the most important indicators , shows the successfulness of each country to achieve a sustainable economy. Since creation of SDG concept, there were many studies that they measured successfulness of businesses efficiencies according to these goals. However, there are few studies that they evaluate hotel industry's financial efficiency in parallel of SDG 8.

As a result, this thesis is going to investigate parallel success of efficient countries in economic sustainability, and financial efficiency of their hotel industry. To measure the financial efficiency, this study applied Data Envelopment Analysis (DEA) to benchmark countries in 2017 and 2018. "Number of rooms" and "Number of employees" as inputs and "RevPAR" and "Occupancy rate" as outputs have been selected to analyze hotel's financial efficiencies. The analysis of this study showed that 5 countries (Estonia, Netherlands, New Zealand, Switzerland and United States) were fully financial efficient in hotel industry. Based on the study's result,

recommendations for policy makers and possible future studies have been illustrated accordingly.

Keywords: Hotel financial efficiency , Data envelopment analysis , Decent work and economic growth, Sustainable development goals , SDG 8

ÖZ

Son on yılda, sürdürülebilirlik trendi dünyadaki çoğu ülke tarafından giderek daha fazla uygulanmaktadır. Sonuç olarak, Birleşmiş Milletler bünyesindeki tüm ülkeler 2015 yılında sürdürülebilir kalkınma hedeflerini (SKH) ortaya koyarak sürdürülebilirliği bir çerçeveye oturtmaya karar vermişlerdir. SKH, sürdürülebilirliğin çevresel, sosyal ve ekonomik sürdürülebilirlik gibi tüm yönlerini kapsayan 17 hedeften oluşmaktadır. Bu hedefler, sadece ülkeler için sürdürülebilirliği uygulamak için eşsiz bir fırsat değil, aynı zamanda ülkelerin farklı organizasyon ve işletmelerde sürdürülebilirlik konusundaki başarılarını değerlendirmelerine ve tahmin etmelerine yardımcı olabilmektedir. En önemli göstergelerden biri olan SKH 8 (insana yaraşır iş ve ekonomik büyüme), her ülkenin sürdürülebilir bir ekonomiye ulaşmadaki başarısını göstermektedir. SKH kavramının oluşturulmasından bu yana, işletmelerin verimliliklerinin bu hedeflere göre başarısını ölçen birçok çalışma icra edilmiştir. Ancak otel sektörünün finansal etkinliğini (SKH 8) değerlendiren az sayıda çalışma bulunmaktadır.

Sonuç olarak, bu tez ekonomik sürdürülebilirlik konusunda etkin ülkelerin paralel başarılarını ve otel sektörünün finansal verimliliğini araştıracaktır. Bu çalışmada finansal verimliliği ölçmek için 2017 ve 2018 yıllarında karşılaştırma yapılan ülkelere Veri Zarflama Analizi (VZA) uygulanmıştır. Otellerin finansal verimliliklerini analiz etmek için, girdi olarak “Oda sayısı” ve “Çalışan sayısı”, çıktı olarak “Oda başına günlük gelir” ve “Doluluk oranı” seçilmiştir. Bu çalışmanın analizi, 5 ülkenin (Estonya, Hollanda, Yeni Zelanda, İsviçre ve Amerika Birleşik Devletleri) otelcilik sektöründe tam finansal etkinliğe sahip olduğunu göstermiştir. Çalışmanın sonucuna

dayalı olarak, politika oluşturucular ve sektör profesyonelleri için öneriler ve gelecekteki çalışmalar bu doğrultuda aktarılmıştır.

Anahtar Kelimeler: Otel finansal verimliliği, Veri zarflama analizi, İnsana yaraşır iş ve ekonomik büyüme , Sürdürülebilir kalkınma hedefleri , SKH 8

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LIST OF ABBREVIATIONS

ADR	Average Daily Rate
CCR	Charnes, Cooper, & Rhodes (1978) Method
CE	Circular Economy
CRS	Constant Returns to Scale
DEA	Data Envelopment Analysis
DMU	Decision-Making Units
EEA	European Environment Agency
EU	European Union
GDP	Gross Domestic Production
ILO	International Labor Organization
MDG	Millennium Development Goals
OCC	Occupancy Rate
OECD	Organization for Economic Co-operation and Development
RevPAR	Revenue per Available Room
SD	Sustainable Development
SDG	Sustainable Development Goal
SME	Small and Medium Enterprises
UN	United Nations
UNWTO	United Nations of the World Tourism Organization
VRS	Variable Return to Scale

Chapter 1

INTRODUCTION

As a result of globalization and the rapid growth of the economy, many economic, social, and environmental problems have been underestimated. This rapid growth of the global economy had serious damages to the earth and its resources (Chen, 2019). Consequently, in 2015, United Nations members established United Nations Sustainable Goals (SDGs) which contain 17 goals and 169 targets to guide other countries to step on certain steps of actions to achieve sustainability in economy, environment and social practices (Trupp & Dolezal, 2020). Among these 17 goals, SDG 8 has been set comprehensively for economic growth and decent employment for everybody (Bilek-Steindl & Url, 2022). However, international labor organization (ILO) declared that for achieving a sustainable economic development with financial and employment growth, social and environmental characters of a destination should be concerned as well (Arbeitsorganisation, 2019). Consequently, Frey (2017) illustrated that during economic growth, economic situation of people does not necessarily have a linear relationship with each other, and therefore, there should be a policy making structure that influences on the employment and the economic growth.

Tourism industry , as one of the greatest industries, contributes to the world economy and it has great impact on it (Peña-Sánchez et al., 2020). For example, in European Union (EU) , over 2.3 million tourism based small and medium enterprises (SME)

hired near 12.3 million employees in 2018 and this amount was equal to 5.1% of the labor market of EU. Moreover, EU tourism industry contributed directly near to 3.9% of the Gross Domestic Production (GDP) of EU countries in 2018 (European Parliament, 2022). As tourism is acting in a production level in the economy for all the countries, therefore, implementing SDG 8 will boost the economic growth of a destination (Peña-Sánchez et al., 2020). Stroebel (2015) mentioned that by considering SDG 8 and sustainable economy concept together, efficiency in economy and natural resources will be conserved. Therefore, SDG 8 with combination of other SDG indicators can encourage a destination to grow sustainably in the destination.

Although all the indicators are playing an important role in the sustainable development of a destination, this study primarily aims to focus on the economic aspect of sustainability and in particular, analyze the financial efficiency of hotel industries among the most economically sustainable destinations. Hotel industry has been chosen from tourism sector, because of their huge volume of resource consumption and their importance in allocating an advance planning structure for a sustainable development (Álvarez Gil, Burgos Jiménez, & Céspedes Lorente, 2001).Therefore, the following research question for the study rises: "Do the countries with high economic sustainability achievements realize parallel success in financial efficiency of their hotel industry?".

Bianchi & de Man (2021) has been stated that a "sustained economic growth" is a priority for all hospitality and tourism businesses and it transformed the work environment into a market-focus orientation and most of the organizational desires are emphasized (UNWTO,2016 , p.24). Therefore, it is essential to encourage other public and private organizations to follow up SDG 8 to optimize "Pro-competitive and

effective policy framework" as their guideline for a sustainable growth (UNWTO ,2017a). Although both UNWTO and ILO have decided to come up with an integrated platform in 2008 to provide a "dignified work" for employees, they couldn't solve serious labor issues in sustainable growth of tourism and hospitality (Gascón, 2019). Therefore, this study by using financial data of hotel industry, analyzes effectiveness of economic SDG practices on the hotel industry of the most economically sustainable regions.

In order to achieve aforementioned aim of the study, this paper's objective has been established in four stages. In the first part, relevant literature related to SDG and sustainability in hotel industry is discussed and examples of previous studies that are related to this topic are presented.

Second, countries will be benchmarked by the most effective economic sustainability indicators based on the existing data from the United Nation database. For choosing the most effective indicators out of the 17 sustainable economic goals of the United Nation (UN), Khoshnava et al. (2019) found out four indicators as the most effective ones for the economic aspect of sustainable development and it has been found that SDG 8 (decent work and economic growth) is relatively more connected to the sustainable economic development of a country . Based on the ratings of the SDG 8 benchmarks, countries will be ranked from highest to lowest and the ones at the top of the list will be chosen for further analysis of this study.

Then, in the third part, financial data of the hotel industry from those countries that ranked top in the first part, will be analyzed by using Data Envelopment Analysis (DEA) method. For defining DEA, Ramanathan (2003) has illustrated this method as

: "…a methodology based upon an interesting application of linear programming. It was originally developed for performance measurement. It has been successfully employed for assessing the relative performance of a set of firms that use a variety of identical inputs to produce a variety of identical outputs." (p. 25).

Based on the above definition, inputs and outputs for DEA should be identified. This study adapted inputs and outputs for its analysis from Chen (2019) study. The aforementioned study has designated room numbers, employee numbers, annual expense, and building size as its inputs and Revenue as its output; however, Schwartz, Altin, & Singal (2017) suggested RevPAR as an accurate tool for performance measurement in the hotel industry where Sharma, Suri, & Savara (2020) used RevPAR as their output. As Nurmatov, Fernandez Lopez, & Coto Millan (2021) showed most commonly used inputs and outputs for hotel DEA efficiency applications, as inputs , accommodation size (room number) and number of employees have been repeatedly mentioned, and in the output side, RevPAR and occupancy rate has been utilized. Therefore, room numbers and number of employees as the input ,and RevPAR and occupancy rate as outputs has been designated for this study respectively.

In the next step, for achieving the aim of study, secondary data is used from STR Global Inc. and United Nation sustainable Goals databases as the study's sample. Sakouvogui (2020) recently illustrated in his study that 10 years sample period would be more accurate in robust estimation to use DEA. However, for this study, conducting a long-term analysis of the sample would be challenging due to two key reasons. First, the concept of SDG has been created since 2015 and it is quite a new agreement released by UN (Dlouhá & Pospíšilová, 2018). Second, because of this short period of time and effect of COVID-19 on the tourism trends (Kock et al., 2020), it is suitable

to exclude missing data after 2019 for inputs and outputs. Therefore, two years of 2017 and 2018 has been chosen for the period of the study. It is important to highlight this fact that DEA studies with short period of time have been used by other scholars as well (Higuerey et al., 2020; Hsieh & Lin, 2010).

At the end, by comparing the final benchmarks, the trend of changes of hotel industry's efficiency (which were conducted by DEA) and sustainable development economic indicators, this study will reach into a conclusion, that either the most economically sustainable countries are efficient in hotel management as well or not. By interpreting the result, target efficiencies of each country will be provided for the stakeholders of the hotel industry and the governments. Moreover, countries will have a clear perspective about their hotel industry financial positions. For improving their efficiencies, countries will be advised to refer their numbers and efficiencies to reference countries for elevating their efficiency numbers. These reference countries are those frontier ones, that they have been found full efficient in compare to other countries in the study's sample. In this case , inefficient countries can follow up policies of efficient countries to achieve a full financial efficient. At this point, countries will realize that how close they are following SDG 8 policy in hotel industry.

In the following chapter, core concepts of sustainability and SDG will be discussed in tourism and hospitality industry. In addition, literature related to the study's method and its usage in tourism and hospitality industry will be explained accordingly. Further, in the third chapter, method of this study (DEA) will be presented and desired inputs and outputs will be identified for the sample of the study. Then , in chapter four , the result of DEA will be illustrated based on different parameters. In the final

chapter, significant implementations and findings, in addition of all possible future studies, will be discussed.

Chapter 2

LITERATURE REVIEW

2.1 Tourism Sustainable Development

The idea of sustainability in different humankind activities has been identified in the early 1990s in international organizations such as United Nations (UN). It became a great concern for all the countries to have sustainable development in different aspects such as environment, society, and economy (IFC, 2012). In this vein, the UN has conducted conferences related to sustainable development and the most important one was the "RIO+20" summit which was held for all the UN members in 2012. This summit was not only considering sustainable development alternative plans for the next twenty years, also it had an important accomplishment that environmental, social, and economic issues are not separate from development (Lavrinenko et al. , 2019).

According to Navarro et al. (2020), tourism has significant effect on sustainable development of a country. Although Navarro et al. (2020) has conducted a study related to tourism sustainability, it is mentioned that sustainability in tourism doesn't have a single definition. One of the common definitions which were used widely in the literature was created by the United Nations of the World Tourism Organization (UNWTO) in 2005 (UNWTO, 2005). Accordingly, tourism sustainability has been described as "tourism that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment, and host communities." (UNWTO, 2005, pp. 11-12). Apart from the

UNWTO definition, the agenda for sustainable and competitive European tourism in 2007 has been accepted which states that the tourism sustainability comprises not only the protection of environmental and social resources but also, is expected to give some advantages and support for the local economy and cultural heritages (European Commission, 2007).

Although sustainable development (SD) is a concept that was committed to the three different aspects of development in the environment, society, and economy, some scholars put attention on the tourism development and its impact on nature to apply further strategies for a sophisticated and balanced growth for present and the future (Bricker, 2018; Higham & Miller, 2018). Hence, the concept of sustainability can be achievable by policies that can co-create a measurable and concrete system to interact with the social, environmental, and economic aspects of developments (Megwai, Njie, & Richards, 2016). In this vein, it is necessary to maximize not only the benefits of SD in the environment and quality of life for residents, but also to boost the local economy and market to a higher level (Arbolino et al. 2021).

Recently, tourism become one of the most effective sectors around the world which has a great impact on the society's culture by introducing globalization to the host communities (Mathur, 2011). This continuous change will affect both the tourism industry sector and also the communication between the local community and tourists (Saha et al., 2021). eventually, the development of sustainable tourism is expected to encourage local handicrafts and ethnic cultural elements (Ali, Amin, & Tahmeen, 2018).

Despite the positive socio-cultural impacts, tourism growth can also cause some diverse problems such as noise, pollution, and environmental damage. Therefore, many developed countries are trying to apply the ecotourism concept to attract investors around the world. This will create more job opportunities at the local and national levels in that country (Saha et al., 2021).

In addition to several benefits of sustainable development, it is fundamental to consider all the factors and stakeholders in the policy planning for tourism for the destination (Adongo, Taale, & Adam, 2018). Önder, Yıldırım and Ozdemir (2013) declared that consideration of all interest groups is a difficult task for any policymaker to reach a single plan because every stakeholder in the region has different expectations and benefits from tourism development. Hence, the role of consultants and government becomes stronger to intervene in the development plans for maximizing the benefits of all stakeholders in businesses and society (Fraiz, de Carlos, & Araújo, 2020).

2.2 Sustainability in the Hotel Industry

The hotel industry, similar to other businesses, has been adopting increasing sustainable practices in the recent years in order , They specifically pay more attention on the environmental impacts of their entity (Segarra-Oña et al., 2014). As Kim, Barber, & Kim (2019) defined a sustainable hotel as " a lodging business that maintains its operations in a manner that considers the environmental consequences (e.g., saving water and energy and reducing emissions and waste production), the economic consequences (e.g., influencing suppliers to provide less packaging), and the social consequences (e.g., local initiatives relating to providing education, alleviating poverty, and donating to charity)" (p. 577) . This wide and comprehensive

definition from Graci & Kuehnel (2011) included all the possible aspects of sustainability.

The existence of hotels or accommodation will produce pollution in the environment (Singh, Sundari, & Nath, 2015). These pollutions are from food and water waste, construction waste, and also sewage which are produced all from the hotel buildings. By implying the sustainable principles, these environmental damages will be reduced (Burton, 2012). Moreover, by using sustainable principles in the hotel industry, the cultural system of the host community would be preserved and they would encourage efficient operations of both the host community and customers of the hotel industry. This aim will be reached by expanding the social capital in a destination (Courtnell, 2019).

Relating to the economic section of the hotel industry, sustainable principles are improving the financial situation of the destination with a balanced consumption strategy (Petri & Mikuli, 2012). These principles will not only encourage hoteliers to have more profit in the market, but also it will benefit the society to enrich the quality of their lives and it will be effective for a long period (Kasemsap, 2018; Kim et al., 2019).

In order to attain sustainable principles, it is crucial to apply certain planning strategies (Dos Santos, Méxas, & Meiriño, 2017). At first, the scope of planning and evaluations should be recognized in the hotel industry (Aragon-Correa, Martin-Tapia, & de la Torre-Ruiz, 2015). In the second stage, these findings should be distributed to the different entities and businesses to form a structure inside an organization (Chen, 2015). Finally, all the stakeholders such as government, private organizations, and

academia should participate integrally to reach a sustainable structure (Dos Santos et al., 2017).

2.3 Sustainable Development Goals (SDG)

The beginning of SDG was backed to 2001, in which, UN held the Millennium Summit. In this summit, Millennium Development Goals (MDG) has been established and eight initiatives has been derived out of this summit (Salvia et al., 2019). The aim of these goals was basically made for developing the world in a way that it becomes a suitable habitat for everybody by 2015 and it is concentrated on education, health, poverty, gender equality, hunger and environment (McArthur & Rasmussen, 2018). Although these goals for overcoming issues in sustainable development has remained same since 2000, there are other problems and new challenges that appeared during these years and the necessity of development goals became even more important (Orzes et al., 2018).

As a result, a multidimensional plan has elaborated out of MDG and it is called Sustainable Development Goals (SDG). This new roadmap has not only focused on the environmental aspects of development but also contains social and economic development with 169 targets and a further 17 main sustainable development goals from these targets. These goals have been accepted by all UN members and it is estimated to be implemented to all the countries around the world by 2030 (Dlouhá & Pospíšilová, 2018).

Although SDG has brought some new goals for development, it has been argued by Kumar, Kumar and, & Vivekadhish (2016) that these goals are in the same path of MDG to fill the possible development gaps of that roadmap. However, the SDG is

concentrating on global sustainable development for all the countries and targets are focusing mainly on the humanity and environmental aspect, but the MDG was focusing only on the political and poverty issues in developing countries (Fukuda-Parr, 2016; Kumar et al., 2016). As a result, it is believed that SDG targets are more comprehensive and contain all the three sustainable aspects of sustainable development (Costanza et al., 2016).

Below in Figure 1, there are 17 goals of SDG (United Nation,2015) which are categorized in different subjects of sustainability that are expected to be achieved by 2030:

Figure 1: Sustainable Development Goals (SDGs) (United Nations,2015)

These 17 goals will be accomplished not only through the investment of public sector, also a multi-stakeholder plan for private sectors is required (Halkos & Gkampoura, 2021). Therefore, many sectors should take in action for assessing a certain outcome to involve education system, regional governments and organizations in harmony. In

this multi-sector collaboration, economic efficiency, environmental protection and social justice will be accessible, if there are any instructions for the policies of sustainability in a certain country (Leal Filho et al., 2019). Also, it is argued by (Leal Filho et al., 2019) that although all the SDG disciplines were elaborated for a global context, it is more implementable in a local scale. Hence, all the decisions which are made in a regional scope will affect a larger scale and general SDG of each country will be more impressionable by these local regulations and policies (Salvia et al., 2019).

Although sustainable development idea became so popular in the global context, Bianchi & de Man (2021) argued that there are some critiques about the successfulness of this idea. In Hospitality industry as the characteristics of tourism products are different (e.g. they are perishable and intangible as same as other service oriented products), tourism labor market are lacking of a formation of a suitable labor union to support them and persuade governments to provide decent work and economic growth (Rossman & Greenfield, 2012), therefore , the neoliberal structure of trading environment abuses this issue and allow labor agencies to reduce the bargaining power of tourism employees (Sheikh, 2010).

This fragility character of labor market in tourism also is a great concern from UNWTO and it is believed that “tourism’s ability to bolster decent work is a complex issue” (UNWTO, 2018, pp. 55-56). The main reason of this complicated issue, is coming from the nature of tourism that seasonality affects the work condition of the employees who work in tourism and hospitality sector, therefore, protecting the job security and social support should be a priority of the industry to achieve a decent work condition in this industry (UNWTO, 2017a). However, Fingar (2018) stated that all

the plans that came from UNWTO failed to achieve in tourism industry and hospitality and they could not follow their recommendation for SDG as it was expected (UNWTO, 2017b). By understanding the sensitive shape of work condition and decent work environment, existence and performance of SDG 8 among the other goals of sustainability for all countries will draw a greater picture of economic and employability growth (Anholon et al., 2021).

2.4 Decent Work and Economic Growth (SDG 8)

One of the goals related to the economic sustainability is SDG 8 and it is called "Decent Work and Economic Growth". Palmer (2012) illustrated economic growth as "an increase in the productive capacity of an economy as a result of which the economy is capable of producing additional quantities of goods and services". This fact can be understood that not only the national income of a country will grow up, also there will be an increase in the national economic output of a country and it can evolute the lifestyle and environment standards into a higher level (Acemoglu, 2012; Hess, 2016; Ranis, Stewart, & Ramirez, 2000).

For all the citizens, basic essentials such as health, residency rights and food are necessity of a life and it should be a guaranty for them to access these human rights and achieve them through a decent work for a better quality of life (Frey & MacNaughton, 2016). To reach these basic rights, ILO encourages the idea of decent job and it is believed that it can reduce poverty as the result of identifying these rights and increasing employment rate (ILO,2015). According to United Nation SDG target progress chart in 2020 (United Nations, 2020), most of the developed countries could manage to reach to a satisfactory level of decent work and employment by this date. Among these countries, South and south-eastern countries in Asia also could tackle

the economical goal of sustainability, however, there are countries that couldn't make significant progress for economic sustainable development such as countries in Latin America, Sub-Saharan Africa and Caribbean region.

In order to achieve a better perspective about SDG 8 progress, Sachs et al., (2021) published a report related to SDG accomplishments. In (Sachs et al., 2021) study, SDG 8 score index progress has been elaborated based on different continents from 2010 to 2020 (Figure 2). In the graph below (Figure 2), as the authors presented information in a linear graph, the most successful and stable categories of countries are belonging to those ones which are member of Organization for Economic Co-operation and Development (OECD):

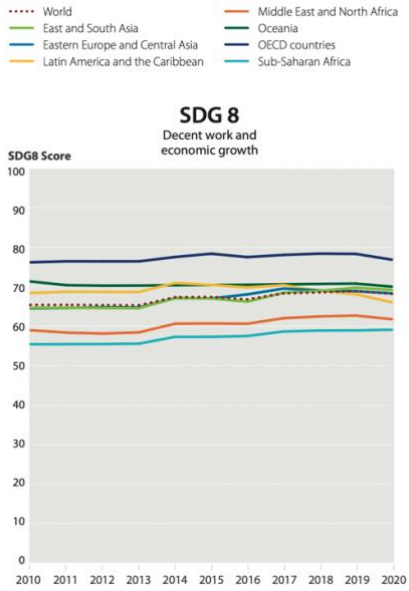

Figure 2 : SDG 8 Score Indexes of Different Continents Over Time (2010-2020) (Sachs et al., 2021)

Based on the trends in Figure 2, two group of continents (Middle-East, North Africa and Sub-Saharan Africa) are only below the world average. Although there were slight increases in the trend of these regions, they were scored more than 60 till 2020. Except

OECD countries that was fluctuated between 70 and 80, other categories of countries were in the range of average score of SDG 8 score index. By understanding this great success of OECD countries in SDG 8, it is essential to narrow down study analysis to OECD countries (Lamichhane et al. , 2021). As this study is going to examine the financial efficiency of hotel industry, an overview of previous studies related to SDG 8 of OECD countries in their economy is needed.

2.4.1 OECD Countries and SDG 8

OECD, as one of the development organizations has been established in 1961 and one of the aims and strategies of this group is to reach to the 2030 sustainable development by following UN instructions. For reaching a desirable result, sufficient knowledge and related tools should be available. As OECD countries have a sophisticated data resources and performance of development has been evaluated simultaneously, therefore it enables to analyze development performances among their countries (Sustainable Development Goals, UNDP ,2018).

As a result, this integrated and available database is enriching a holistic plan for a strong and sustainable country in the future (Lamichhane et al., 2021). As SDG goals are concerning about all the sustainability areas such as environment, economy and socio-cultural development factors of a destination, therefore, these valuable data from OECD encourage stakeholders to tackle on the resource management issues and publicize the usage of renewable resources to fight against negative implications of countries development (Alfaro Navarro, Andrés Martínez, & Mondéjar Jiménez, 2020; Sachs et al, 2021). Another field that OECD is working is to gather all the members and to find solutions and road plans for sustainable development for each of the stakeholders within this organization. The sustainable development indicators are one

of the performance analysis tools for their corporation to implement convenient policy making strategies (Singh, Murty, Gupta, & Dikshit, 2012).

By understating the importance of the SDG in OECD countries, Halkos & Gkampoura (2021) stated that the most successful goal among the SDG indicators belong to the SDG 8, which is mostly achieved in the world. Therefore, the importance of analyzing the organizational efficiency ,among those countries that are more successful in the SDG 8, is becoming necessary for their performance evaluation (Lamichhane et al., 2021).

Additionally, Schroeder, Anggraeni, & Weber (2019) illustrated a study about the relationship of the Circular Economy (CE) to the SDGs in the developed countries. Among the all definitions of circular economy, European Environment Agency (EEA) has illustrated CE as: “The concept can, in principle, be applied to all kinds of natural resources, including biotic and abiotic materials, water and land. Eco-design, repair, reuse, refurbishment, remanufacture, product sharing, waste prevention and waste recycling are all important in a circular economy.” (Reichel et al. , 2016, p. 9) Accordingly, it is shown in the findings of Schroeder et al. (2019), that SDG 8 has the significant and direct contributions to the economy of developed countries with concern of environmental and social sustainability and it has same effect on the OECD countries (Căutişanu et al., 2018).

2.5 Data Envelopment Analysis (DEA)

2.5.1 Background and Definition

After introducing DEA as a useful and easy tool for performance analysis for organizations and firm in 1978, there were many scholars that used this method as a comprehensive tool for efficiency analysis. It could not only be used as an operational evaluation tool for companies, but also DEA brought a feature to them to benchmark their financial outcome (Zhu, 2009). Moreover, this empirical method helped many companies to excise other statistical methods (e.g., that they were used for efficiency analysis (Takamura & Tone, 2003).

Charnes, Cooper, & Rhodes (1978) defined DEA as a "mathematical programming model applied to observational data that provides a new way of obtaining empirical estimates of relations – such as the production functions and/or efficient production possibility surfaces – that are cornerstones of modern economics.". Moreover, Charnes et al. (1987) has introduced the method of DEA by assuming that all the units in analysis are functioning optimal that they have constant returns to scale (CRS) to those Decision-making Units (DMU) that they are the most efficient and stand as frontiers ,therefore, this method is mainly used to evaluate the performance of other DMUs in compare to frontiers (Ji & Lee, 2010). However, later this method has been developed.

In addition, it is useful for the entities to find out hidden relations and unknown factors related to the performance of DMUs. This specific character of DEA creates a possibility for researchers to focus more on frontiers of DMUs rather than propensity to the center in a regression model, therefore, it would be more convenient to evaluate

two different DMUs efficiencies (Cooper, Seiford, & Zhu, 2011). In addition, Cooper et al. (2011) mentioned that DEA is based on the input and output structure that can be used for situations that inputs and outputs are not necessarily connected.

Besides the main definition of DEA, there are two other ones in the literature which have been mentioned by Cooper et al. (2011). First definition is called "Efficiency – Extended Pareto-Koopmans". The Pareto-Koopmans assumes that if a DMU is going to have full efficiency, there will be neither input nor output will not improve to have a full efficiency without worsening some of the inputs or outputs. However, this will be not sufficient for social science and efficiency of DMU is not possible in theory (Cooper et al., 2011). As a result, another definition has been created for efficiency called "Relative efficiency", in which, that DMUs efficiency will be independent toward the score changes of inputs and outputs. Relative efficiency is breaking the dependency and weight assumptions for any input and output. This unique character of the performance evaluation is commonly used for economic metrics and it has the potential to come within other economic factors such as prices and costs as well. Therefore, it creates the basic method of DEA in managerial scale (Cooper et al., 2011).

In addition to relative efficiency, Sexton, Silkman, & Hogan (1986) stated that DEA is mostly used for measuring the technical efficiencies of DMUs. In other words, any inputs of this evaluation will not cause any external output and this performance measurement only relies on the technical efficiency of those DMUs and it cannot be extended to the price efficiency of the sector. This fact has been examined so long ago by Farrell (1957) that a perfect efficiency of a DMU doesn't revile any fact that this unit is price efficient.

In the DEA method, every DMU efficiencies are calculated and benchmarked based on those units that they are frontier and efficient in the industry. Accordingly, Farrell (1957) has proposed two different orientations that are either input or output-oriented. However , Lovell (1993) stated that if the production efficiency of a DMU is focusing on the demand of market and there is a possibility for modifying the number of inputs, therefore an input-oriented approach is more suitable. In addition, DMUs that are concerning more on the cost control of their company, they should adopt an input-oriented approach (Casu & Molyneux, 2003). As a result , for hotel industry that is basically paying attention on the guests demands and they have a great concern on the cost efficiency in their entities, DEA efficiency analysis approach should be input-oriented (Tsaur, 2001).

2.5.2 DEA and Hospitality Industry

DEA, as an effective tool for computing efficiency of hotels and accommodation industry for a long time, (Anderson, Fish, Xia, & Michello, 1999; Hwang & Chang, 2003; Morey & Dittman, 1995; Tsaur, 2001). Therefore, defining this analysis is crucial for understanding the core concept of analysis method of the study. Most studies have adopted the method of Charnes et al. (1978) that is known as CCR model and all the efficiencies of DMUs are calculated to identify the frontiers and the calculated numbers are between 0 to 1 . As the DEA has been used for a long time, here in Table 1, there are some studies which were conducted specifically for the Hospitality industry :

Table 1 : Usage of DEA in Hotel Industry

Authors	Inputs	Outputs	Findings
Anderson et al. (1999)	Employee numbers , Room quntity , Food and Beverage (F&B) expenses, Total gaming sector expenses	Hotel Revenue	The average efficiency of US hotels is close to 1
Assaf & Cvelbar (2011)	Fix assets, Matrials ,Employee Numbers	Room and F&B sales	The effect of the international reputation and private sector on the efficiency of hotels in Slovenia
Assaf & Magnini (2012)	Employee numbers, Fixed equities , Operational costs	Occupancy rate (OCC) and Revenue	Results indicate hotel efficiencies higher than 0.7 in US
Günaydın, Correia, & Kozak (2022)	F&B cost, Capital cost , Labor cost	Hotel Revenue	Comparing financial efficiencies of all-inclusive hotels with Bed and Breakfast (B&B) hotels. Results indicate higher efficiency for B&B hotels.
Hsieh & Lin (2010)	Front office and catering costs, Employee numbers of catering and front office department , room quantities and catering space	Hotel Revenue from front office and catering sections	The efficiencies were fluctuating between 0.1 and 0.4 .
Keh, Chu, & Xu (2006)	Number of rooms , Marketing Expenditures	Revenue (Room and F&B sectors)	Inefficiennt hotels by increasing their marketing tasks, the revenue also increases
Pulina, Detotto, & Paba (2010)	Cost of Labour	The value-added revenue	All Sample hotels in Italy could reach the efficiency more tha 0.7
Sellers-Rubio & Casado-Díaz (2018)	Available beds , Full-time employee numbers , Hotel numbers	Revpar, ADR, Average OCC	
Yin, Tsai, & Wu (2015)	Number of guest rooms, Hotel employee number , Hotel space, Costs	OCC and Revenue	All the efficiencies in the hotel samples in Taiwan were located above 0.6.
Yu & Lee (2009)	Surface area, Number of employees, Number of rooms , Capacity of F&B and hotel rooms , Expenditures	Hotel Revenue	Two-stage DEA result showed lower scores than basic model of DEA

Firstly, according to table 1, DEA method has been widely used to measure financial efficiency in hotel industry and different types of input and outputs has been utilized. Therefore, the usage of this method is useful to evaluate successfulness of hospitality DMUs. Second, As the focus of study is on the evaluation of parallel success of SDG 8 and financial efficiencies of hotel industry, Sachs et al. (2021) report about SDG 8 performances of OECD countries is fulfilling the study's aim. As a result , choosing OECD countries as the most suitable sample of study is justified.

Chapter 3

METHODOLOGY

3.1 Data Envelopment Analysis (DEA)

In the previous chapters , it has been discussed about DEA definition and usage of it in different industries. As it is mentioned, Farrell (1957) was the first one that was looking for a comprehensive method for measuring the efficiency of a company and this method could use multiple inputs and outputs to calculate more accurate productivity efficiency. However , DEA basic method has been developed later by Charnes et al. (1978) that called CCR method by the name of the authors. This method can evaluate efficiencies of multiple inputs and outputs, moreover, it has a potential to analyze those inefficient input and outputs together. In addition, Farrell (1957) couldn't measure the zero slacks, however, in CCR method, this possibility is available for the performance evaluation. As a result, CCR is a suitable DEA method for efficiency analysis.

3.2 CCR Method

The analysis method of DEA has been commonly used both in global perspective (Emrouznejad & Yang, 2018) , and in the field of tourism and hospitality sector for finding business performance efficiencies (Assaf & Josiassen, 2016). Also recently , this trend in hospitality and sustainable economy research has been examined in many countries such as Tunisia , Greece and Ecuador (El Alaoui et al. ,2022; Higuerey et al., 2020; Karakitsiou et al., 2020) This evaluation tool has two advantages. First, it is a great method for technical financial analysis for hospitality sector and secondly, it

is more flexible related to the economical tourism variables. It must be noted that CCR model of DEA is a the most common one in the hospitality industry (Nurmatov et al. , 2021).

CCR is calculated based on the ratio of the outputs with inputs . This method can be shown as follow (Charnes et al.,1978):

$$\max_{v,u} \theta = \frac{u_1 y_1 + u_2 y_2 + u_3 y_3 + \cdots + u_n y_n}{v_1 x_1 + v_2 x_2 + v_3 x_3 + \cdots + v_m x_m}$$

In this equation , the θ is the efficiency of a DMU and for reaching the maximum efficiency of a DMU , there should be assumed weights such as u and v for a maximum level of inputs and outputs (y , x). In this equation, n and m are the number of inputs and outputs respectively. Based on this equation , the DMUs will be benchmarked and the frontiers will be identified in the performance efficiency. In the CCR system , all the multiple inputs and outputs to the single virtual input and output to measure. For interpreting this equation , all the DMUs efficiencies should be $0 \leq \theta \leq 1$. Those DMUs that their efficiency is 1 , are the most efficient one among the others (Cooper et al. , 2011).

As a result, in the mathematical language, the related equation is assumed as follow:

Max $\theta_o(u, v) = \frac{\sum_n u_n y_{no}}{\sum_m v_m x_{mo}}$

Therefore, it subjects to : $\frac{\sum_n u_n y_{ni}}{\sum_m v_m x_{mi}} \leq 1$ for $i = 1,2, \dots, k$, $u_n, v_m \geq 0$ which are true for all of the n and m values.

3.2.1 Input and Output-oriented Models of DEA

Based on the studies structure, DEA can be implemented in two ways of input and output-oriented. For output-oriented method, Kamble & Pradhan (2015) stated that an output-oriented method is a model that evaluates the efficient output level to the existence inputs level and it is evaluating a desirable output for a constant inputs level. However, the input-oriented analysis, is focusing on the efficient level of the inputs by keeping all the outputs untouched. In the field of tourism, Oliveira, Pedro, & Marques (2013) illustrated that output-orientation analysis is suitable for the tourism industry, however, it has been also mentioned that in the hospitality industry mostly input-oriented methods are usable and practical.

According to Banker, Charnes, & Cooper (1984) , there are two types of efficiency scales in CCR and they are called Constant Return to Scale (CRS) and Variable Return to Scale (VRS). In the CRS method , only pure technical efficiencies are calculated , however, VRS can also calculate scale efficiency as well as technical ones (Barros, 2005). As this study focuses on the hotel industry efficiencies among the most sustainable countries in SDG 8, input-oriented approach with VRS method has been chosen because of its ability to include the scale efficiency of a DMU (Günaydın et al., 2022). Moreover, this study is going to evaluate performances with undesirable inputs that are employee numbers in hotel industry and room number. These inputs are directly related to the economical aspect of this industry and they are included in SDG 8 (Decent work and economic growth) (Cagarman, Kratzer, von Arnim, Fajga, & Gieseke, 2020; Tao & Binbin, 2015). Moreover, the usage of VRS has been frequently used in hotel industry efficiency measurements studies (Ablanedo-Rosas, Rubio, Chen, & Ruiz-Torres, 2021; Cordero & Tzeremes, 2017; Frančeškin & Bojnec, 2022; Karakitsiou et al., 2020).

As a result , for conducting a VRS method of CCR with the input-oriented approach with undesirable inputs (Banker et al., 1984; Charnes et al., 1978; Parte-Esteban & Alberca-Oliver, 2015; Zhu, 2009), this linear programming (LP) is as follow :

$$Min\ \theta - \varepsilon(\sum_{i=1}^{m} s_i^- + \sum_{r=1}^{s} s_r^+)$$

That subject to :

$$\sum_{j=1}^{n} \lambda_j \overline{x}_{ij} + s_i^- = \theta \overline{x}_{io} \quad i = 1,2,3,\dots,m;$$

$$\sum_{j=1}^{n} \lambda_j \overline{y}_{rj} - s_r^+ = \overline{y}_{ro} \quad r = 1,2,3,\dots,m;$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda_j \geq 0 \qquad j = 1,2,3,\dots,n.$$

The main difference of VRS and CRS method is $\sum_{j=1}^{n} \lambda_j = 1$ that this equation exists in VRS method only. In this LP, θ refers to efficiency score of i , r is the number of outputs and i is the number of inputs in the DEA analysis. Moreover, j refer to the number of observations and λ_j dedicates to the weight of the observations. Another value is ε, that indicates a non-Archimedean value which is smaller than any positive number (Zhu, 2009).

As this study assumes that inputs are not desirable ones, inputs (x_{ij}) are converted to ($\overline{x}_{ij} = x_{ij} + u_i$) and outputs (y_{rj}) are transformed to ($\overline{y}_{rj} = y_{rj} + v_r$) ,that u_i and v_r are the positive numbers.

According to Cooper, et al. (2011), another parameter that indicates efficiency is the slacks $(s_i^-, s_r^+)$of the envelopment analysis. If both $\theta = 1$ and $s_i^- = s_r^+ = 0$,as a result this DMU is efficient and inefficient DMUs are having $\theta < 1$ and if $s_i^- \neq 0$ and/or $s_r^+ \neq 0$. Another possibility refers to the $\theta = 1$ and $s_i^- \neq 0$ and/or $s_r^+ \neq 0$ that shows a weakly efficient DMU in an envelopment analysis.

Each DMU's lambda value (λ_j) is defining the strength of the endorsements for each of them , therefore, this LP can calculate all the possible combination of input and output efficiencies in this network that creates the connections for inputs and outputs and its referencing strength in DEA method (Liu & Lu, 2009). Consequently, the target efficient values of a DMU for each input and output will be extracted by following LP (Zhu, 2009) :

$$\hat{x}_{io} = \theta^* x_{io} - s_i^{-*} \qquad i = 1,2,3,\dots,m$$

$$\hat{y}_{ro} = y_{ro} + s_r^{+*} \qquad r = 1,2,3,\dots,s$$

According to this LP, θ^*refers to the efficiency of the targets , $(\hat{x}_{io}, \hat{y}_{ro})$ are the efficient target values of inputs and outputs and (s_i^{-*}, s_r^{+*}) are the slacks of those efficient targets of a $DMU_o(x_{io}, y_{ro})$.

3.3 Data Sample and Measurements

3.3.1 Data Sample

For conducting this study, multiple data samples have been used. As this study is going to focus on a macro level of the hotel industry for the countries, each country assumed as a single DMU. As it was discussed in first and second chapter of this study, the aim of this study is to analyze the financial performance efficiencies of those countries that are successful in SDG 8. In chapter two, Sachs et al. (2021) showed that OECD countries has shown the best performance among the others. Therefore, OECD group

has been chosen for the sample of study. Therefore, based on the availability of data , this study chose 21 countries data from OECD group (Australia ,Austria ,Belgium ,Chile ,Colombia ,Czech Republic ,Estonia ,France ,Germany ,Italy ,Japan ,Korea ,Netherlands ,New Zealand ,Poland ,Portugal ,Slovakia ,Spain ,Switzerland ,Turkey and United States) for two years of 2017 and 2018 . For choosing inputs and outputs, this study adapted measurements of Sellers-Rubio and Casado-Díaz (2018) study, therefore ,inputs are "Number of hotel employees" and "Hotel room numbers" and for outputs , "Revenue Per available room (REVPAR)" and "Occupancy rate (OCC%)" have been selected. Data related to the REVPAR and OCC has been collected from STR company and number of employees and hotel room numbers have been extracted from OECD and UNWTO database respectively (OECD, 2022; UNWTO, 2022).

Below , there are Table 2 and Table 3, that show the input and output numbers for all the 21 countries in OECD group :

Table 2 : OECD Inputs and Outputs Data in 2017

Country	Inputs		Outputs	
	Room numbers	No. emp/thousands	RevPAR ($)	OCC%
Australia	277807	859.264	108.1	75.5
Austria	291046	269.941	84.57	71.5
Belgium	76941	153.009	81.97	70.7
Chile	112255	204.276	79.17	66.2
Colombia	252155	347.115	49.38	56.5
Czech Republic	137318	1600.883	70.23	75.1
Estonia	16208	174.037	63.77	69.5
France	641265	1592.875	86.39	66.3
Germany	963690	1664.574	82.23	71.2
Italy	1086910	25.806	111.41	68.7
Japan	1463983	1076.788	110.36	84
Korea	867355	1463.236	88.51	65.2
Netherlands	124049	3925.364	99.56	74.3
New Zealand	88757	2320.87	108.17	79.8
Poland	162512	405.411	55.26	72
Portugal	175056	137.185	86.59	70.2
Slovakia	40088	407.914	49.6	67.1
Spain	919401	324.282	97.03	74.3
Switzerland	141404	105.803	143.73	65.9
Turkey	432403	1548.013	45.78	60.4
United States	5206059	10425.796	83.53	65.9

Table 3 : OECD Inputs and Outputs Data in 2018

Country	Inputs		Outputs	
	Room numbers	No. emp/thousands	RevPAR ($)	OCC%
Australia	284680	863.989	105.87	75.3
Austria	292458	265.186	93.02	72.4
Belgium	78954	167.581	93.13	73.9
Chile	120487	200.795	74.89	62.8
Colombia	269763	367.221	51.28	57.7
Czech Republic	141450	1572.348	72.84	74.2
Estonia	16084	188.569	69.57	70.5
France	654478	1596.061	99.12	68.4
Germany	976515	1728.112	86.95	71.7
Italy	1091180	28.712	117.17	69.5
Japan	1533848	1098.038	114.5	83.3
Korea	875431	1473.887	86.88	64
Netherlands	131903	4093.952	109.05	75.1
New Zealand	90723	2268.893	108.08	79.9
Poland	170640	434.189	56.94	71.1
Portugal	184428	139.177	92.78	69.6
Slovakia	41720	431.029	52.4	65
Spain	922464	329.373	99.11	74.1
Switzerland	140884	111.095	147.61	67.4
Turkey	449920	1666.555	54.88	66.2
United States	5310180	10448.141	85.96	66.2

3.3.2 Analysis Software (R-Studio)

For analyzing data, this study used an open-source coding software of “RStudio-version 554” for MacOS 12.6 . As “RStudio” needs to load packages to analyze the relevant data, this study has been used “deaR” package (version 1.2.6) to apply DEA method (Coll-Serrano, Bolos, & Suarez, 2022). Based on this information about the details of the analysis software, all the data has been analyzed and is interpreted in the next chapter.

Chapter 4

DATA ANALYSIS

In this chapter, the results of the study will be discussed and analysed. After applying related syntaxes in "R-Studio", there are different parts extracted from the data that it is used. First, the efficiency result of different countries will be shown and evaluated. Moreover, all these results will be visualized in two different figures to show those efficient and inefficient hotel industries of these countries in case of performance efficiencies. Then, the calculated slacks (Cooper et al., 2011) and lambdas (Liu & Lu, 2009) will be observed and interpreted. Finally, the targets will be shown that how much those countries are far or close by the number of inputs and outputs.

4.1 Efficiencies

Based on the results that CCR method of DEA found, there are only three countries that are showing full efficiencies. Based on the Charnes et al. (1978), the efficiency numbers are between 0 to 1. Therefore, those countries with efficiency score equal to 1 are the most efficient ones in technical efficiencies. Among those 21 countries, 6 countries (Estonia, Japan, Netherlands, New Zealand, Switzerland and United States) showed significant efficiency during period of 2017 and 2018. Below, Table 4 presented efficiency scores of all the countries in these two years:

Table 4: Efficiency Scores in 2017 and 2018

DMU	Efficiencies -2017	Efficiencies-2018
Australia	0.78407	0.66733
Austria	0.63254	0.61815
Belgium	0.83835	0.85048
Chile	0.76564	0.75486
Colombia	0.64026	0.62586
Czech Republic	0.80077	0.79163
Estonia	1	1
France	0.68987	0.67491
Germany	0.66635	0.65701
Italy	0.66608	0.64822
Japan	1	1
South Korea	0.66118	0.6485
Netherlands	1	1
New Zealand	1	1
Poland	0.69007	0.68508
Portugal	0.66039	0.65358
Slovakia	0.94771	0.94556
Spain	0.60881	0.5792
Switzerland	1	1
Turkey	0.70613	0.69815
United States	1	1
Mean	0.79801	0.785644

According to the efficiency scores of these 21 countries, except those full efficient ones, only three countries were standing above the mean score of the efficiencies (Belgium, Slovakia and Czech Republic). Although Australia and Chile could reach a better score than other great countries in this analysis, they couldn't stand above the average of the scores. Moreover, results show slight differences between two years in performance efficiencies.

According to Cooper et al. (2011), fully efficient DMUs are recognized not only by their efficiency scores, also slacks of each DMU can show us the right position of every DMU in case of efficiency as well. Accordingly, Table 5 and 6 are illustrating the slack values of each input and outputs for all the study's sample in 2017 and 2018 respectively.

Table 5: DMU Slacks for 2017

DMU	slack_input.rooms.2017	slack_input.No..emp.thausends	slack_output.revpar.2017	slack_output.OCC
Australia	0	0	0	0
Austria	3.29088E-06	0	14.80058838	0.02700745
Belgium	7.30129E-08	0	0	0.01705267
Chile	0	0	7.744961981	0.064041022
Colombia	1.28214E-06	0	50.06204526	0.177381897
Czech Republic	0	0	28.75600435	0
Estonia	6.57643E-06	0	0	0
France	1.38042E-06	0	12.16587359	0.074738202
Germany	1.60057E-06	0	15.69575365	0.022436264
Italy	3.39712E-06	0	0	0.020071222
Japan	0.001332333	0	4.10908E-09	0
Korea	2.11679E-06	0	9.632372731	0.083571385
Netherlands	3.83101E-06	0	0	0
New Zealand	1.56565E-05	0	0	0
Poland	0	0	40.34947788	0.017701731
Portugal	0	0	10.16769763	0.037241673
Slovakia	0	0	21.39955134	0.033695962
Spain	0	0	2.28042943	0
Switzerland	3.33129E-08	0	0	0
Turkey	1.50205E-06	0	53.2081868	0.136003599
United States	0	0	0	0

Table 6: DMU Slacks for 2018

DMU	slack_input.rooms.2018	slack_input.No..emp.thausends	slack_output.Revpar.2018	slack_output.OCC
Australia	0	0	2.847924649	0
Austria	2.58127E-07	0	15.8120442	0.026159893
Belgium	0	0	0	0.016585883
Chile	0	0	20.20040678	0.106735023
Colombia	0	0	57.60532466	0.173365262
Czech Republic	0	0	29.41731437	0.001085523
Estonia	9.63599E-09	0	0	0
France	2.25408E-06	0	8.548552392	0.061675234
Germany	1.91906E-06	0	19.82735745	0.025240139
Italy	4.3397E-07	0	0	0.024836599
Japan	4.29097E-05	0	0	0
Korea	3.7882E-06	0	20.22671727	0.103509651
Netherlands	3.80228E-06	0	0	0
New Zealand	6.55274E-08	0	0	0
Poland	8.32621E-08	0	46.99642745	0.034041937
Portugal	0	0	12.39613586	0.050486379
Slovakia	0	0	25.13449496	0.064279807
Spain	1.93429E-06	0	8.14572637	0.003084004
Switzerland	6.68328E-06	0	0	0
Turkey	5.82239E-07	0	53.35752062	0.085868312
United States	0	0	0	0

Based on the findings in both tables of 5 and 6, only United States showed full efficiency ($\theta = 1$ and $s_i^- = s_r^+ = 0$), however, other efficient countries based on the slack's values ($\theta = 1$ and $s_i^- \neq 0$ and/or $s_r^+ \neq 0$) are showing a weak efficiency in this study.

Below, Figure 3 and 4 show the frequency distribution of efficient and inefficient countries hotel industry in the period of 2017 and 2018 respectively:

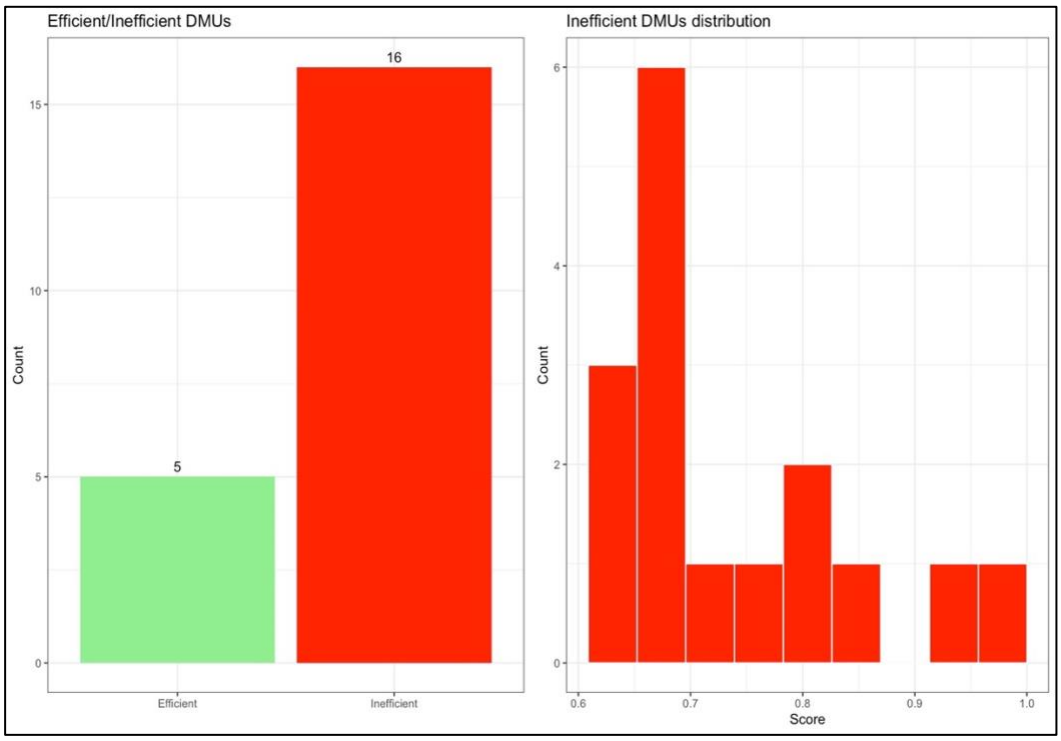

Figure 3: Efficient and Inefficient DMUs Distribution in 2017

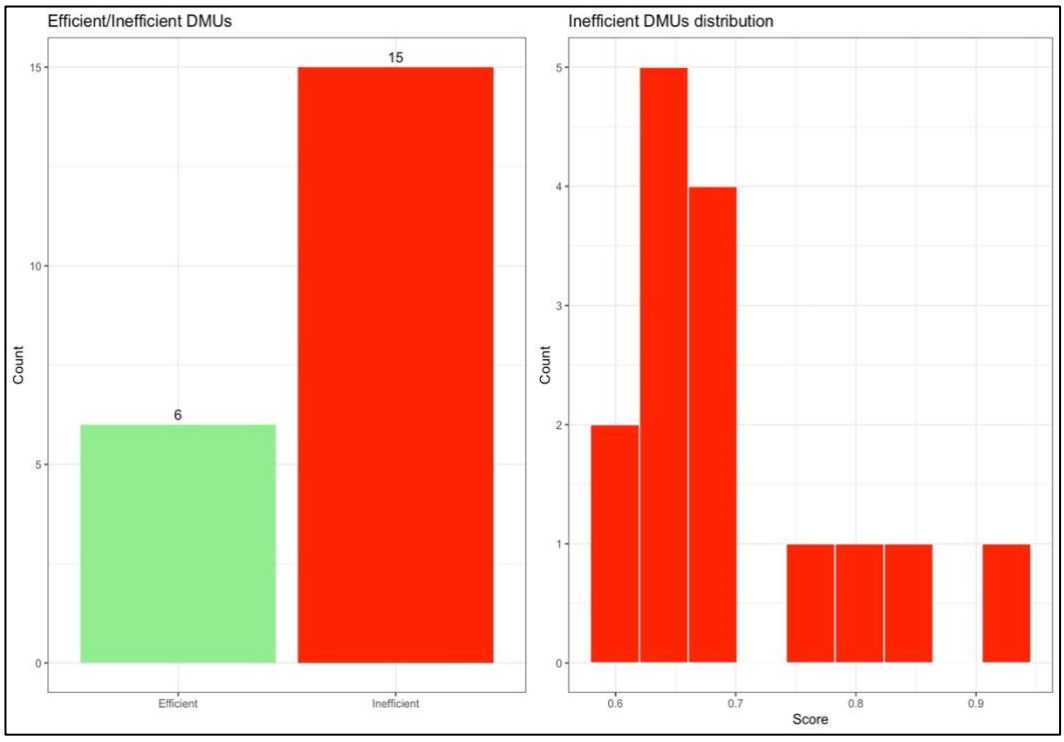

Figure 4: Efficient and Inefficient DMUs distribution in 2018

By looking at aforementioned figures, in 2017, 5 DMUs as efficient ones and they have listed the rest of the countries inefficient in compare to those good ones. Although

Japan was listed as an efficient DMU, it has been omitted in 2017 from the list of the efficient countries and it appeared in 2018 only. In the bar charts of Non-efficient DMUs in Figure 4 and 5, it is presented that in both 2017 and 2018, the density of non-efficient countries is shifted to the lower numbers and number of those ones that they have efficiency score lower than 0.7 are significantly higher than other DMUs. As a result, by comparing Figure 3 and 4, the number of efficient DMUs has changed only by one unit, moreover, the average efficiency has been downgraded slightly in this period.

In addition, In Figure 5 and 6, those fully efficient countries have been shown and it gives us the number of the countries that they should look after those frontier countries as their reference countries for increasing their efficiencies in the future:

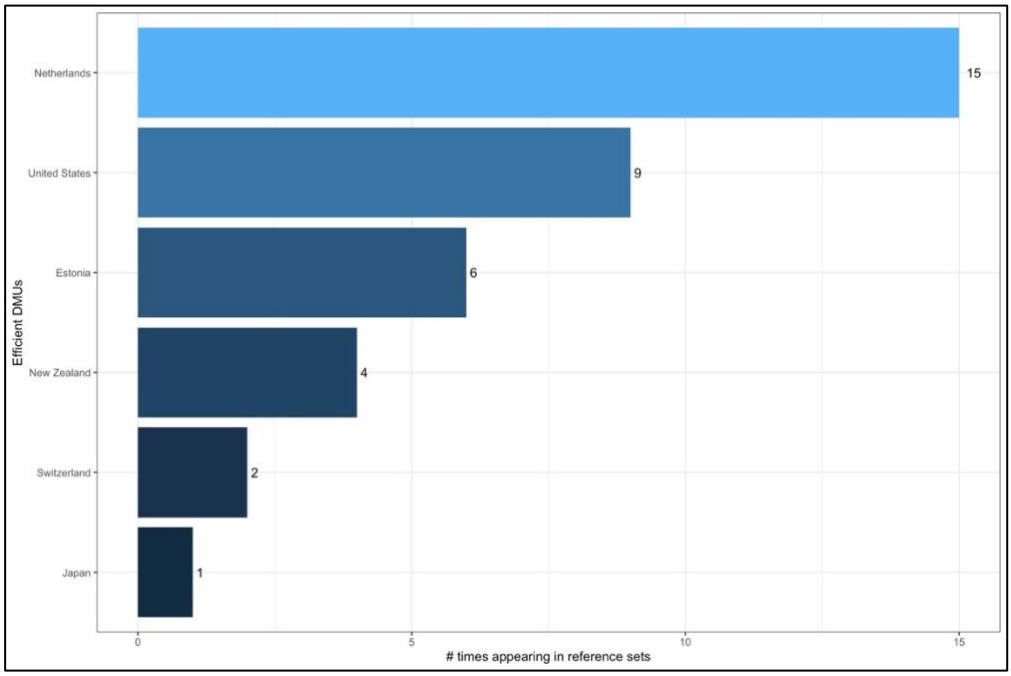

Figure 5: Frontiers and Reference Quantity Sets - 2017

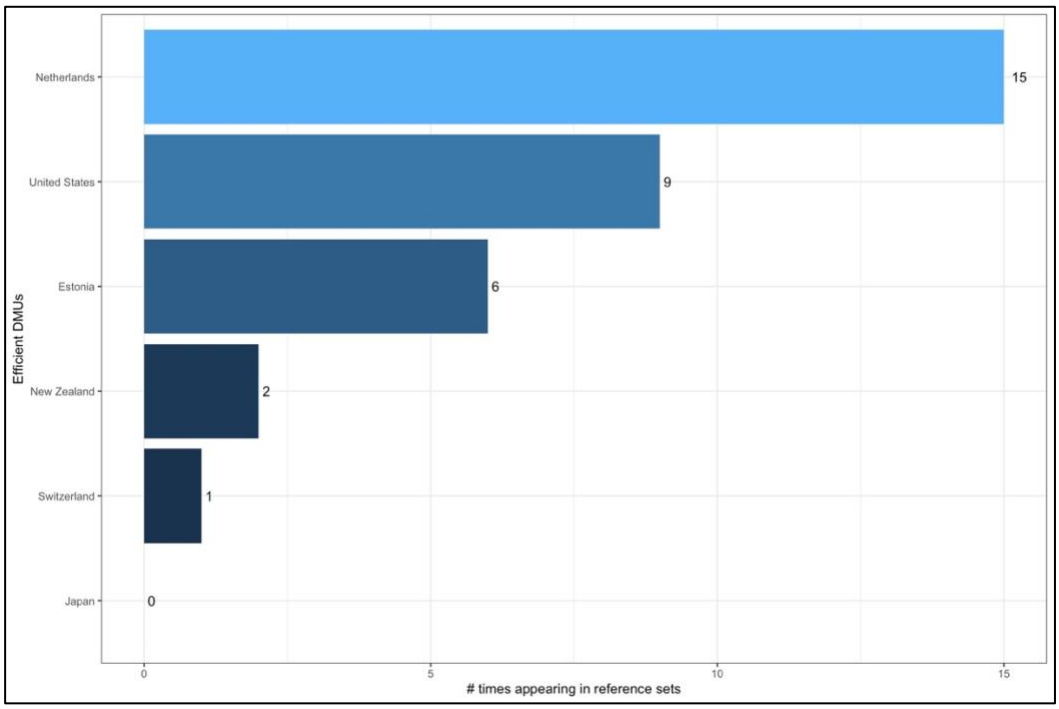

Figure 6: Frontiers and Reference Quantity Sets – 2018

As it has been illustrated in Figure 5 and 6 , Netherlands was referencing most of the OECD countries as their frontiers. In 2017, it was leading in efficiency scores and 15 countries were referring it and this amount was the same in 2018. The United States with referencing of 9 countries placed as the second frontier. In the third position , Estonia maintained its position and it was introduced as the third frontier with 6 referencing countries. According to Figure 5, It has been illustrated that New Zealand could be the reference for 4 countries in 2017, however, this amount has been declined and reached to only 2 countries in 2018 for this country. Same trend happened for Switzerland as well , that only 2 countries were referencing it as its frontier, however, this amount decreased by one unit in 2018. For Japan , as it has been shown , only one country could refer it as its reference and later analysis in Figure 7 , it is referencing itself only in 2017. Also, Japan has been known as an efficient DMU in 2018,however, there are no other links to other countries in 2018 as Figure 8 is showing the reference sets of DMUs. This can be caused because of the characteristics of the Japan economy

and its historical path to modernizations and adapting to the western capitalistic free market (Appadurai, 1994). Below, Figure 7 and 8 are showing efficient countries with reference sets connections and following that , the target efficient values of each input and outputs are shown in Table 7 and 8 for 2017 and 2018 respectively.

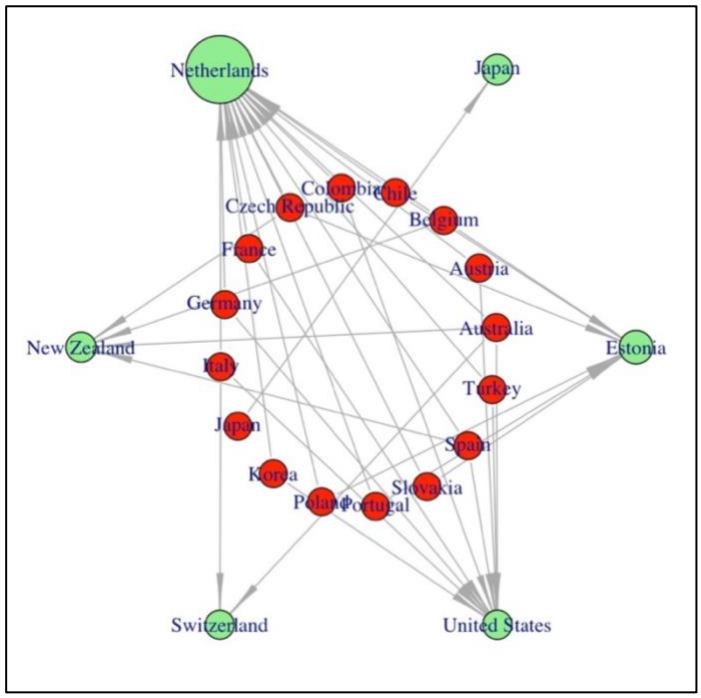

Figure 7: Efficient and Inefficient DMUs Connections and Tendencies in 2017

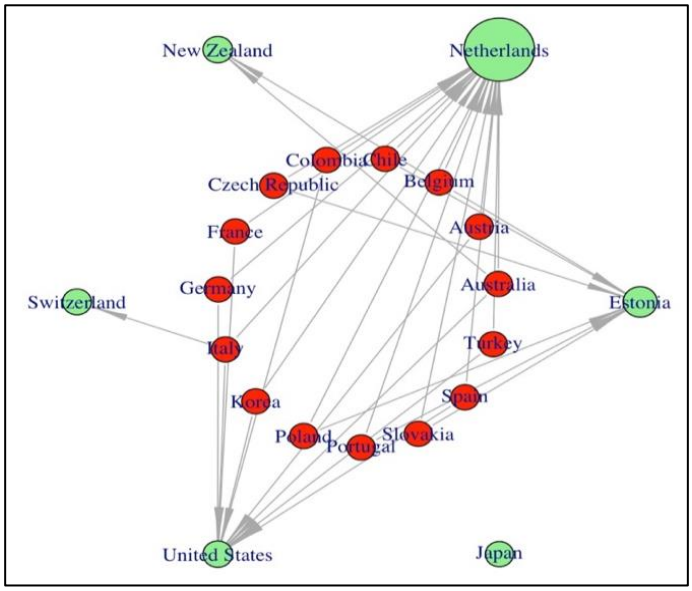

Figure 8: Efficient and Inefficient DMUs Connections and Tendencies in 2018

Table 7: Target Values and Changes - 2017

DMU	Room numbers 2017	Room Numbers target.2017	Room Number Change	No. emp in thausends	No..emp.thausends target	No. Emp. Thausends Change	Re-vpar ($) million dollars	Revpar million dollars target 2017	Change Revpar million dollars	OCC%	OCC% Target	OCC% change
Australia	277807.00	217820.45	▼59986.55	859.26	2925.17	▲2065.91	108.10	108.10	0	75.5%	75.5%	0
Austria	291046.00	184098.39	▼106947.61	269.94	4002.17	▲3732.23	84.57	99.37	▲14.80	71.5%	74.2%	▲0.03
Belgium	76941.00	64503.53	▼12437.47	153.01	1813.76	▲1660.75	81.97	81.97	▲0.00	70.7%	72.4%	▲0.02
Chile	112255.00	85947.48	▼26307.52	204.28	2599.97	▲2395.70	79.17	86.91	▲7.74	66.2%	72.6%	▲0.06
Colombia	252155.00	161444.33	▼90710.67	347.12	3973.20	▲3626.08	49.38	99.44	▲50.06	56.5%	74.2%	▲0.18
Czech Republic	137318.00	109960.66	▼27357.34	1600.88	3359.24	▲1758.35	70.23	98.99	▲28.76	75.1%	75.1%	0
Estonia	16208.00	16208.00	0	174.04	174.04	0	63.77	63.77	0	69.5%	69.5%	0
France	641265.00	442388.39	▼198876.61	1592.88	4332.55	▲2739.68	86.39	98.56	▲12.17	66.3%	73.8%	▲0.07
Germany	963690.00	642156.07	▼321533.93	1664.57	4588.08	▲2923.50	82.23	97.93	▲15.70	71.2%	73.4%	▲0.02
Italy	1086910.00	723965.19	▼362944.81	25.81	3498.94	▲3473.14	111.41	111.41	0	68.7%	70.7%	▲0.02
Japan	1463983.00	1463983.00	▼0.00	1076.79	1076.79	0	110.36	110.36	0	84.0%	84.0%	0
Korea	867355.00	573481.06	▼293873.94	1463.24	4500.24	▲3037.00	88.51	98.14	▲9.63	65.2%	73.6%	▲0.08
Netherlands	124049.00	124049.00	0	3925.36	3925.36	0	99.56	99.56	0	74.3%	74.3%	0
New Zealand	88757.00	88757.00	0	2320.87	2320.87	0	108.17	108.17	0	79.8%	79.8%	0
Poland	162512.00	112145.44	▼50366.56	405.41	3511.29	▲3105.88	55.26	95.61	▲40.35	72.0%	73.8%	▲0.02
Portugal	175056.00	115605.21	▼59450.79	137.19	3631.64	▲3494.46	86.59	96.76	▲10.17	70.2%	73.9%	▲0.04
Slovakia	40088.00	37991.80	▼2096.20	407.91	931.80	▲523.89	49.60	71.00	▲21.40	67.1%	70.5%	▲0.03
Spain	919401.00	559739.60	▼359661.40	324.28	4276.29	▲3952.01	97.03	99.31	▲2.28	74.3%	74.3%	0
Switzerland	141404.00	141404.00	0	105.80	105.80	0	143.73	143.73	0	65.9%	65.9%	0
Turkey	432403.00	305331.62	▼127071.38	1548.01	4157.24	▲2609.23	45.78	98.99	▲53.21	60.4%	74.0%	▲0.14
United States	5206059.00	5206059.00	0	10425.80	10425.80	0	83.53	83.53	0	65.9%	65.9%	0

Table 8: Target Values and Changes - 2018

DMU	Room numbers 2017	Room Numbers target.2017	Change	No. emp in thausends	No..emp.thausends target	No. Emp. Thausends Change	Re-vpar ($) million dollars	Revpar million dollars target 2017	Change Revpar million dollars	OCC%	OCC% Target	OCC% change
Australia	284680.00	189974.52	▼94705.48	863.99	4052.71	▲3188.73	105.87	108.72	▲2.85	75.30%	75.3%	0
Austria	292458.00	180782.84	▼111675.16	265.19	4153.93	▲3888.75	93.02	108.83	▲15.81	72.40%	75.0%	▲0.03
Belgium	78954.00	67148.53	▼11805.47	167.58	1704.91	▲1537.33	93.13	93.13	0	73.90%	75.6%	▲0.02
Chile	120487.00	90950.97	▼29536.03	200.80	2713.06	▲2512.27	74.89	95.09	▲20.20	62.80%	73.5%	▲0.11
Colombia	269763.00	168833.90	▼100929.10	367.22	4139.27	▲3772.05	51.28	108.89	▲57.61	57.70%	75.0%	▲0.17
Czech Republic	141450.00	111975.90	▼29474.10	1572.35	3422.02	▲1849.67	72.84	102.26	▲29.42	74.20%	74.3%	0
Estonia	16084.00	16084.00	0	188.57	188.57	0	69.57	69.57	0	70.50%	70.5%	0
France	654478.00	441713.24	▼212764.76	1596.06	4474.12	▲2878.05	99.12	107.67	▲8.55	68.40%	74.6%	▲0.06
Germany	976515.00	641577.00	▼334938.00	1728.11	4719.37	▲2991.25	86.95	106.78	▲19.83	71.70%	74.2%	▲0.03
Italy	1091180.00	707325.54	▼383854.46	28.71	3694.40	▲3665.69	117.17	117.17	0	69.50%	72.0%	▲0.02
Japan	1533848.00	1533848.00	0	1098.04	1098.04	0	114.50	114.50	0	83.30%	83.3%	0
Korea	875431.00	567713.14	▼307717.86	1473.89	4628.73	▲3154.84	86.88	107.11	▲20.23	64.00%	74.4%	▲0.10
Netherlands	131903.00	131903.00	0	4093.95	4093.95	0	109.05	109.05	0	75.10%	75.1%	0
New Zealand	90723.00	90723.00	0	2268.89	2268.89	0	108.08	108.08	0	79.90%	79.9%	0
Poland	170640.00	116901.76	▼53738.24	434.19	3588.11	▲3153.93	56.94	103.94	▲47.00	71.10%	74.5%	▲0.03
Portugal	184428.00	120538.59	▼63889.41	139.18	3710.75	▲3571.57	92.78	105.18	▲12.40	69.60%	74.6%	▲0.05
Slovakia	41720.00	39448.74	▼2271.26	431.03	976.42	▲545.39	52.40	77.53	▲25.13	65.00%	71.4%	▲0.06
Spain	922464.00	534295.63	▼388168.37	329.37	4587.72	▲4258.35	99.11	107.26	▲8.15	74.10%	74.4%	0
Switzerland	140884.00	140884.00	0	111.10	111.09	0	147.61	147.61	0	67.40%	67.4%	0
Turkey	449920.00	314113.62	▼135806.38	1666.56	4317.54	▲2650.99	54.88	108.24	▲53.36	66.20%	74.8%	▲0.09
United States	5310180.00	5310180.00	0	10448.14	10448.14	0	85.96	85.96	0	66.20%	66.2%	0

Based on the target values and changes of Table 7 and 8 , both years illustrates for number of employees, RevPAR and occupancy rates, target values are more than the real values and numbers. However, according to the changes of room numbers for each country, it has been showed that they are exceeding from the efficient number of rooms in each country.

According to the aforementioned tables, for expected room numbers, other than 7 countries (Austria ,Colombia, France, Germany, Italy, South Korea and Spain), there should be less expectation for decline. Moreover, Table 7 and 8 shows us a huge change for those 7 countries along with Poland and Portugal in case of necessity to increase the number of employees in hotel industry.

In the output side, both of Table 7 and 8 shows us a great gap between real and target RevPAR of the hotel industry of 4 countries (Colombia, Poland, Slovakia and Turkey) and in occupancy rate, 3 countries (Colombia, South Korea and Turkey) experienced a significant gap between real and target efficient value.

Chapter 5

CONCLUSION

By utilizing DEA method, this study aimed to evaluate hotel efficiencies of the most sustainable countries according to SDG program around the world and furthermore, it measured parallel successfulness of economic sustainability of these countries in comparison to their hotel industry's financial efficiency. According to Peña-Sánchez et al. (2020), SDG 8 is the most relative indicator to understand the economic sustainability of a destination. Based on the SDG report conducted by Sachs et al. (2021), it has been realized that OECD countries could relatively achieve the highest performance of SDG 8 among the rest of the countries around the globe ,therefore, this study chose its sample from OECD countries to analyze their hotel industry's performance efficiencies. To analyze hotel industry efficiencies, DEA method for undesired inputs has been applied. Two inputs ("Number of employees" and "hotel room numbers") from OECD and UNWTO datasets (OECD, 2022; UNWTO, 2022), and two outputs ("RevPAR" and "OCC%") from STR company has been selected based on the literature.

5.1 Discussion

Based on the study's results, only 5 countries (Estonia, Netherlands, New Zealand, Switzerland and United States) show financial efficiency in the hotel industry in 2017 and 2018. It is important to mention that one of the countries (Japan) has been identified efficient as well, however, it couldn't make any references to other countries, therefore, it has been omitted from the list of efficient countries.

At the top of the list, Netherlands is a frontier that it has been selected 15 times as a reference for inefficient countries. Netherland as the most efficient country in the hospitality industry, also, it has been shown efficient in general among OECD countries for service-based industries such as health care system (Gavurova, Kocisova, & Sopko, 2021) and educational system (Rubio & Dominguez-Gil, 2021) recently. In Addition to the financial efficiency, Netherland was illustrated as a successful country for the greenhouse gas emissions to maintain a sustainable environment within OECD countries. In another study conducted by Lozano-Ramírez, Arana-Jiménez, & Lozano (2022), the sustainable efficiency of tourism industry of all the European countries has been analyzed from 2015 to 2019. Although Netherlands has been ranked among the top 5 efficient countries in the previous study, it has not been placed in the first position of this ranking (i.e., Spain) and it could only stand in the 5th and 4th position during this period. However, apart from Lozano-Ramírez et al. (2022) study's result, by observing aforementioned researches, it reveals that Netherland is following sustainability goals not only in the financial field, also it tackled other aspects of sustainable development.

In the second position, United States illustrates an efficient position in financial efficiency of its hotel industry. In study of Gusaroj & Caceres (2022), tourism industry efficiency of OECD countries has been measured. Moreover, previous study, United States showed a quite a significant efficient level among other OECD countries. In Addition, Gusaroj & Caceres (2022) has been declared that other countries such as Estonia and Switzerland are efficient countries, and aforementioned findings are supporting the result of this study to accept Estonia and Switzerland as successful countries in the hotel industry financially.

Along these mentioned countries, there are two countries that showed an interesting result after conducting DEA analysis. First, it reveals that Japan ,as one of the countries in OECD group, is an efficient country with no bindings to other inefficient DMUs. Although Wu & Lin (2022) showed in their study that Japan is an efficient cultural tourism destination among Asian countries, the full efficiency of Japan comes into the question in the context of hospitality with no reference lines to the other countries. Second, Although Spain has been showed five years continuously as the most efficient country in the tourism industry (Lozano-Ramírez et al.,2022), in the hotel industry it is the least efficient country.

Although considering aforementioned financial details of the study's sample is important for businesses to adjust their technical functionality, there will be a great picture by solving the puzzle of finding's detail. Most of OECD countries, as the flagship of other countries in SDG 8 performance, didn't achieve full efficiency in their hotel industries. SDG 8 , as one of the key economic indicators, could not help these countries to find a suitable path for decent economic growth in hotel industry. Despite the fact that this goal is not helping community to overcome unemployment and decent economic growth, this impracticality has been criticized by Bianchi & de Man (2021) in the whole system of sustainable tourism development. The previous research argues about the failure of this system because of the "capitalistic" structure of tourism; however, this assumption hasn't been tested before. Hence, this study , by utilizing DEA method and different financial datasets, could answer this question so far. As a result , to answer the research's question , it is concluded that majority of the most economical sustainable destinations in the world (i.e., OECD) are not efficient in hotel industry.

5.2 Recommendations for Policy Makers

Based on the result of this study and target values of each country in Table 7 and 8, there are some recommendations for all the stakeholders of the hotel industry of inefficient countries in OECD group. By looking at all the target values in the input side, it has been suggested that in one hand, total number of rooms should be less than the real number of constructed sites, on the other hand, total number of employees in the hotel industry should be more than the factual quantity. In other words, the number of employees for this size of accommodation sector is not enough. Hence, policy makers should focus more on unemployment issues in these countries to step into the aims of SDG 8 which is focusing on the decent work and economic growth of any destination to maintain a financial efficient sector (Sachs et al., 2021).

On the output side, although target values are not encouraging countries to boost up their level of occupancy rate significantly, the RevPAR of each country should be increased based on the recommended target value. Therefore, it is concluded that number of hotel guests should not be increased so much. Moreover, hotel industry should be more efficient in RevPAR and this aim will be applied only by reducing costs while the number of hotel's guests are not recommended to increase.

5.3 Limitations and Future Studies

Similar to other studies, this study had some limitations during each step of it. First, this study used a small sample due to limited available data. Moreover, SDG concept has been introduced recently by United Nation in 2015 (United Nations, 2015). Because of these issues, this study used limited number of inputs and outputs to conduct a DEA analysis. It is suggested that ,in the future, by using more available data and financial numbers, there will be a possibility to elaborate a study with a

greater number of inputs and outputs in a wider timeline and this can help researchers to draw a better picture of hotels financial efficiencies. Second, this study analyzed parallel success of financial efficiency of hotel industry and the most economic sustainable countries, however, benchmarking countries based on the other aspects of sustainability such as environmental and social principles will create a brighter picture of destinations in general to achieve the best result in the sustainable development context . Third, this research has been used only a single method of DEA. There are studies (e.g., Günaydın et al., 2022 and Yin et. al., 2015) that they mixed other method to their studies. Hence, it will be suitable to combine another method with DEA analysis to enrich the accuracy of the results in the future studies. Lastly, this study has focused on the financial efficiency of the hotel industry. Other researchers by choosing other service-based industries (e.g., Banking and Health-care system), they can apply DEA analysis to maintain sustainable goals to the relative industry.

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