NEVŞEHİR HACI BEKTAŞ VELİ ÜNİVERSİTESİ
Ara, bul.

Kapadokya Akademik Bakış Dergisi
Cilt: 9 Sayı: 1 Periyod
E-ISSN: 2602-3474

# ÜLKELERİN COVID-19'A KARŞI ETKİNLİKLERİNİN YAPISAL VE KÜLTÜREL ÖZELLİKLERİ İTİBARIYLA DEĞERLENDİRİLMESİ

## *EVALUATING COUNTRIES' EFFICIENCIES AGAINST COVID-19 CONCERNING THEIR STRUCTURAL AND CULTURAL CHARACTERISTICS*

**Yetkin ÇINAR**
Ankara Üniversitesi
ycinar@ankara.edu.tr
ORCID No: 0000-0002-4710-0346

**Geliş Tarihi:**
01.06.2025

**Kabul Tarihi:**
29.06.2025

**Yayın Tarihi:**
30.06.2025

**Anahtar Kelimeler**
Covid-19, Pandemi, Etkinlik, Sağlık Politika Performansı, Kültürel Yapı

**Keywords**
*Covid-19, Pandemic, Efficiency, Health Policy Performance, Cultural Structure*

**ÖZ**

Koronavirüs (COVID-19), ilk olarak 2019 yılında Çin'de ortaya çıktıktan sonra hızla yayılmış ve tüm dünyada önemli zararlara neden olmuştur. Dünya ülkeleri çeşitli politika araçları kullanarak bu afetle mücadele etmiştir. Ancak sosyo-ekonomik ve kültürel farklılıklar nedeniyle bazı ülkeler diğerlerinden daha iyi performans göstermiştir. Bu bağlamda, bu çalışmada 20 Şubat 2020 - 20 Şubat 2022 (aşılamanın yayılmasından önce) dönemlerinde ülkelerin pandemiye karşı yönetim etkinlikleri ve performansları değerlendirilmiştir. Aynı zamanda verilerden, performanslar ile ülkelerin yapısal özellikleri (kültür ve sosyo-ekonomik özellikler) arasındaki bağlantıya dair bazı ipuçları bulunmaya çalışılmıştır. Bu amaçla, öncelikle Veri Zarflama Analizi (VZA) yöntemi ile ve "Etkinlik Ölçüm Sistemi (EMS)" adlı paket program kullanılarak etkinlik analizi yapılmıştır. VZA ile verimsizliğin kaynakları da analiz edilmiş, böylece potansiyel iyileştirmelere ilişkin öneriler elde edilmiştir. Bu nedenle, etkinliğin temel belirleyicileri, etkinsiz olanlar için referans ülkeler (ve etkin olmanın uygun yolu) belirlenmiştir. Ayrıca, etkinlikler ile ülkelerin yapısal özellikleri arasındaki bağlantıları daha açık şekilde gözlemlemek için kümeleme analizi tekniği (Ward'ın Yöntemi) kullanılmış, analizler SPSS programı ile yapılmıştır. Sonuçlar esas olarak; yapısal olarak gelişmiş (daha yüksek gelire ve daha iyi sağlık altyapısına sahip) ve kültürel olarak laik/rasyonel ülkelerin pandemic ile mücadelede daha etkin olduğunu göstermiştir.

**ABSTRACT**

The coronavirus (COVID-19) after first confirmation in China in 2019, has spread rapidly and caused significant damage all over the world. World countries have struggled with this situation using various policy tools. However, due to the socio-economic and cultural differences some countries had better performance, than the others. In this context, this study evaluates the management efficiencies and performances of countries against pandemic between the periods of February, 20, 2020 and February, 20, 2022 (before spread of vaccination). At the same time, from the data, some clues about the linkage between the performances and the structural characteristics (culture and socio- economic properties) of the countries tried to be find out. For this aim, first efficiency analysis is implemented via Data Envelopment Analysis (DEA) method by using Efficiency Measurement System (EMS) program. Via DEA analyses sources of inefficiency and benchmarks, thereby potentially yield managerial insights into organizational improvements, have been find out. Therefore, the key factors of the efficiency, peer countries for inefficient ones (and the suitable way to be efficient for them) have been also determined. Moreover, in order to observe the links between efficiency scores and structural characteristics of the countries more accurately, a clustering analysis technique (Ward's Method) has been used; analyses have been implemented by SPSS program. The results mainly imply that; structurally developed (which have higher income and better health infrastructure) and culturally secular / rational countries have been efficient in the struggle against pandemic.

***DOI:*** https://doi.org/ 10.69851.car.1711576
***Atıf/Cite as:*** Çınar, Y. (2025). Evaluating Countries' Efficiencies Against Covid-19 Concerning Their Structural and Cultural Characteristics. *Kapadokya Akademik Bakış Dergisi*, 9(1), 138-150.

## 1. Introduction

The coronavirus, also known as COVID-19, which first confirmed in Wuhan, China on December 8, 2019, has spread rapidly all over the world and deteriorated the health, socio-economic and environmental conditions of countries. Then, the World Health Organization declared it as a pandemic on March 11, 2020. In order to decrease its spreading rate and negative effects on health of the people, a struggle against it was implemented via some preventions, restrictive policies and extraordinary efforts of the health systems. However, due to the economic, socio-cultural, etc. differences, some countries had better performance, others cannot. Therefore, to determine which countries show better performance and its reasons is a very important question to answer.

In this context our research questions are twofold:

The first one is that "Which countries performed better against Covid-19?". This performance can be measured by different dimensions / objectives such as minimizing Covid-19 cases, maximizing recovery from the illness, maximizing tests for determining cases and doing all these by using minimum stringency measures. The second research question is that "Do these performance measures vary due to some structural differences between countries (socio-economic, cultural, infrastructure, etc.)?"

In order to answer these questions, this study evaluates the management efficiencies and performances against pandemic between the periods of March 2020 – July 2021 (before spread of vaccination) by using Data Envelopment Analysis (DEA) Methodology. At the same time, the linkage between the performances and the structural characteristics (culture and socio-economic properties) of the countries tried to be find out via implementing a cluster methodology, namely Ward's Method. Up to our knowledge, this is the first study which investigates all these aspects at the same time, especially concerning cultural differences, in a performance evaluation against Covid-19, in the post-disease era.

## 2. Literature

There are studies in the literature that measure the performances of countries' struggle against the pandemic, i.e., the effectiveness of various policy measures, the strength of their health systems, etc. during or after the COVID-19 pandemic using different indicators and methods. Methodologically, these are essentially multi-criteria decision-making methods; however, studies that specifically use Data Envelopment Analysis (DEA) also stand out in terms of efficiency measurement.

Aydin & Yurdakul (2020), Jamison, et. al. (2020), Shirouyehzad, et. al. (2020), Sel (2021), Wu (2023), and Aras (2023) can be referred, among others. Moreover, there are studies that implement both DEA and MCDM methods, e.g. Selamzade, et. al. (2023).

Performances were sometimes made by selecting countries that were similar in terms of development or structure which is predetermined. For example, OECD countries, European countries or countries with similar levels of economic development (middle income level, etc.) were initially selected and their performances were measured and compared relatively.

Küçükaycan (2021), Bayram & Yurtsever (2021), Yüksel (2021), Lupu and Tiganasu (2022), Acar et. al. (2023), Polat (2023), Kaya & Yaşar (2024) can be given as examples of such studies.

A comprehensive review of literature can be found in Sotoudeh-Anvari (2023).

One aspect that distinguishes our study from these previous studies in the literature is that, instead of grouping countries in terms of their structural characteristics before measuring their performance, they are grouped using a cluster analysis and then performance comparisons are made between these groups.

Another difference is that, while economic and social structural characteristics were used for grouping the countries in previous studies, no grouping was made in terms of cultural characteristics that particularly affect the level of compliance with measures and rules against Covid-19, and no performance comparison was made in this respect.

## 3. Methodology

### 3.1 Data Envelopment Analysis (DEA)

The efficiency measurement has been implemented via Data Envelopment Analysis (DEA) method, which is a multi-factor productivity analysis model for measuring the relative efficiencies of homogenous decision-making units (DMUs, here, countries). Formally, consider $S$ DMUs $\{1, \ldots, S\}$ produce $n$ outputs $\{q_1, \ldots q_i, \ldots, q_n\}$ by using $m$ inputs$\{x_1, \ldots x_j, \ldots, x_m\}$. The optimal efficiency score for $k$-*th* DMU can be obtained by the following model:

$$Max\theta_k = \frac{\sum_{i=1}^{n} u_i q_{ik}}{\sum_{j=1}^{m} v_j x_{jk}} = \frac{u_1 q_{1k} + u_2 q_{2k} + \ldots + u_n q_{nk}}{v_1 x_{1k} + v_2 x_{2k} + \ldots + v_m x_{mk}} \quad (1)$$

$$s.t. \theta_s = \frac{\sum_{i=1}^{n} u_i q_{is}}{\sum_{j=1}^{m} v_j x_{js}} \leq 1, \qquad s \in \{1, \ldots, k, \ldots, S\}, \quad (2)$$

$$\forall i, j u_i, v_j \geq \varepsilon. \quad (3)$$

Here $u_i$'s and $v_j$'s are the weights prescribed to the outputs and inputs, respectively. The objective function in this model is the ratio of weighted sum of outputs to the weighted sum of inputs of the *k-th* country. The model finds the weights that maximize this ratio. Then the obtained value of $\theta_k$represents the efficiency score of *k-th* DMU. This unit is called "efficient" if $\theta_k$ equals to 1, otherwise it is called "inefficient". The above problem is run *S* times to compute the relative efficiency scores for each DMU in the sample.

The model dual to (1) – (3) was also introduced in Charnes et al. (1978). Both are valid under constant return to scale (CRS) assumption. Banker et al. (1984) modified the model by adding the variable return to scale (VRS) assumption.

### 3.2 Cluster Analysis (Ward's Method)

A class of techniques used to classify units into relative groups by looking at the similarity between them is known as "Cluster analysis". A cluster is a group of relatively homogeneous observations or units (DMUs). Units in a cluster are similar to each other and dissimilar to units in other clusters based on selected properties (here structural, cultural characteristics of the countries). Thus, it provides a simple profile of DMUs and of similar/partitioned groups.

Cluster analysis begins with a basic multicriteria data matrix (or its normalized form) where *n* DMUs $_1 \ldots A_n$are evaluated in terms of *m* criteria $X_1 \ldots X_m$. Then resulting matrix $\mathrm{X} = (x_{\mathrm{ij}})_{n\times m}$ can be given as:

$$\begin{bmatrix} x_{11}x_{12}\ldots x_{1m} \\ x_{21}x_{22}\ldots x_{2m} \\ \ldots\ldots\ldots \\ x_{n1}x_{n2}\ldots x_{nm} \end{bmatrix}$$

Where $x_{\mathrm{ij}}$ are the ratings of each alternative $A_i$ (countries) with respect to each criterion $X_j$ (characteristics). By using **(4)** one can cluster DMUs in accordance with their similarities. For this aim, any valid metric may be used as a measure of similarity between pairs of units. The choice of which clusters to merge or split is determined by a linkage criterion, which may be a function of the pair wise distances between units. At the next stage, a clustering method or algorithm, i.e. the procedure for combining clusters is executed (Romesburg, 2004).

This study utilizes one of the most often used hierarchical clustering methods known as «Ward's minimum variance» by which clusters are merged so as to reduce the variability within a cluster. This method uses an algorithm which starts out with all sample units in *k* clusters of size 1 each and continues until all the observations are included into one cluster. For this aim, an index formulation called the (minimum) sum-of-squares (SS) index, or variance is defined as:

$$SS = \sum_c \sum_i \sum_j |X_{ijc} - \overline{x}_{cj}|^2 \quad (5)$$

where $X_{ijc}$ denote the value for criteria *j* in observation *i* belonging to cluster *c*. Here, summing over all criteria, and all of the units within each cluster, it compares the individual units for each criterion against the cluster means for that criterion ($\overline{x}_{cj}$). When the SS is small, then this suggests data are close to their cluster means, implying that having a cluster of similar units. Ward's method follows a series of clustering steps. At each step the pair of sample units that yield the minimum SS will form a cluster. Clusters or units are combined in such a way and the algorithm stops when all sample units are combined into a single large cluster of size *k* and a dendrogram is constructed.

## 4. Data, Application and Results

### 4.1 Data: Sample and Variables

The data for the initial sample consists of 39 countries. These countries are among the ones which has all available data planned to be used in the study, accounting for a significant percentage of total global

cases (with more than 3 million cumulative cases or more at individual country level). They accounted for 88% of the global cumulative cases as of November 2022 (source: ourworldindata.org).

These countries are (in the descending order of total cumulative cases): United States, India, France, Germany, Brazil, South Korea, United Kingdom, Italy, Japan, Russia, Turkey, Spain, Vietnam, Australia, Argentina, Netherlands, Taiwan, Iran, Mexico, Indonesia, Poland, Colombia, Ukraine, Portugal, Austria, Greece, Malaysia, Chile, Israel, Thailand, Belgium, Canada, Switzerland, Peru, Czechia, South Africa, Philippines, Denmark, and Romania. Taiwan is excluded due to the lack of whole necessary data. Therefore, the final sample consists of 38 countries.

A wide range of criteria that account for political, demographic, capacity, socio-economic and Covid-19 indicators widely used within the most recent literature were selected. The first category of data is on the performance measures against Covid-19, the other is that characterize the social and economic structures of the countries; all are listed in Table 1.

The countries are divided into groups with respect to their structural characteristics (socio-economic, demographic) and cultural map scores. Here, we are controlling the effects of the variation of populations of the countries by dividing all the values of the variables with the population.

**Table 1.** Models and Variables: Inputs and Outputs (Criteria)

| Type of Criteria / Model | Method | Inputs | Outputs |
|---|---|---|---|
| Performance (Efficiency) | Data Envelopment Analyis (DEA) | Mean Stringency Index* | Total Cases / Population (undesirable**)<br>Total Tests / Population<br>Total Recovered / Population |
| Structural & Cultural Differences / Clusters | Clustering (Ward Method) | Selected from;<br>Current Health Expenditure<br>Hospital Beds Per Thousand<br>Population density<br>Population ages 65 + (%)<br>Cardiovascular Death Rate<br>Diabetes Prevalence<br>Share of adults who smoke<br>Extreme Poverty<br>GDP per Capita<br>Human development index<br>Cultural Map Scores | |

(*) A composite measure based on 9 government response indicators value from 0 to 100.

(**) Undesirable outputs are included in the analysis by taking them as inputs.

Data were obtained in December 2024 from the data sources given below:

- *The coronavirus and health system input / output data:* www.ourworldindata.org
- *Cultural Variables:* The Inglehart-Welzel World Cultural Map - World Values Survey 7 (2022): www.worldvaluessurvey.org
- *Government Policies / Measures:* Oxford COVID-19 Government Response Tracker, https://www.bsg.ox.ac.uk/research/research-projects/Covid-19-government-response-tracker
- *Health System Data:* World Health Organisation, www.who.int

- *Economic Indicators:* World Bank, www.who.int

## 4.2 Application and Results

The application has been conducted in two steps.

**1) Calculation of DEA Scores.**

The classical DEA model given in (1)-(3) is applied to the data set and standard DEA (CRS) scores are obtained.

This analysis has been conducted on the average values of the variables in the whole analysis period. Besides in order to determine the key factors of the efficiency, and peer countries for inefficient ones were also determined.

Via DEA analyses (with CRS assumption and input oriented models; since inputs can be more under control), sources of inefficiency and benchmarks, thereby potentially yield managerial insights into organizational improvements, have been find out.

Therefore, using this facility of DEA methodology; the key factors of the efficiency, and peer countries for inefficient ones (and the suitable / shortest way to be efficient for them) have been also determined.

**2) Using Cluster Analysis: Linkages between efficiency and structure**

Second, in order to observe the links between efficiency and structural and cultural characteristics of the countries more accurately, a clustering analysis technique (Ward's Method), which given in (4)-(5) has been implemented.

## 4.3 Results

The results revealed that countries with strong healthcare systems, successful government policy have higher efficiency while struggling against Covid-19. The results also demonstrated the important differences that exist between the countries with respect to their structural characteristics.

### 4.3.1. Efficiency Analysis Results

Results of the efficiency analysis is given in Table 2.

**Table 2.** Efficiency Analysis (DEA) Results

| No | DMU | Efficiency | Case {I} | Stringency {I} | Recovery {O} | Test {O} | Benchmarks |
|---|---|---|---|---|---|---|---|
| 3 | Austria | 100,00% | 0,85 | 0,15 | 0 | 1 | 12 |
| 12 | Denmark | 100,00% | 0 | 1 | 0,8 | 0,2 | 28 |
| 17 | Indonesia | 100,00% | 1 | 0 | 1 | 0 | 6 |
| 22 | Japan | 100,00% | 0,02 | 0,98 | 1 | 0 | 34 |
| 23 | S.Korea | 99,58% | 0,5 | 0,5 | 0,81 | 0,19 | 3 (0,05) 17 (0,37) 22 (0,59) |

**Table 2. (Continued)**

| No | DMU | Efficiency | Case {I} | Stringency {I} | Recovery {O} | Test {O} | Benchmarks |
|---|---|---|---|---|---|---|---|
| 37 | Vietnam | 93,85% | 0,36 | 0,64 | 0,86 | 0,14 | 3 (0,04) 17 (0,85) 22 (0,13) |
| 10 | Czechia | 90,73% | 0 | 1 | 0,95 | 0,05 | 12 (0,43) 22 (0,56) |
| 7 | Switzerland | 88,66% | 0 | 1 | 0,98 | 0,02 | 12 (0,18) 22 (0,82) |
| 32 | Russia | 86,56% | 0,04 | 0,96 | 0,95 | 0,05 | 3 (0,03) 12 (0,11) 22 (0,84) |
| 33 | Thailand | 86,22% | 0,49 | 0,51 | 0,94 | 0,06 | 3 (0,00) 17 (0,12) 22 (0,88) |
| 18 | India | 85,00% | 0,36 | 0,64 | 0,9 | 0,1 | 3 (0,02) 17 (0,72) 22 (0,28) |
| 4 | Belgium | 81,30% | 0 | 1 | 0,97 | 0,03 | 12 (0,23) 22 (0,76) |
| 29 | Poland | 80,77% | 0 | 1 | 0,99 | 0,01 | 12 (0,06) 22 (0,93) |
| 15 | UK | 79,75% | 0,09 | 0,91 | 0,84 | 0,16 | 3 (0,16) 12 (0,36) 22 (0,47) |
| 24 | Mexico | 78,15% | 0,47 | 0,53 | 1 | 0 | 17 (0,08) 22 (0,87) |
| 28 | Philippines | 77,23% | 0,37 | 0,63 | 0,95 | 0,05 | 3 (0,00) 17 (0,54) 22 (0,46) |
| 20 | Israel | 76,98% | 0 | 1 | 0,95 | 0,05 | 12 (0,47) 22 (0,53) |
| 26 | Netherlands | 76,80% | 0 | 1 | 0,98 | 0,02 | 12 (0,13) 22 (0,87) |
| 38 | S.Africa | 76,75% | 0 | 1 | 1 | 0 | 12 (0,01) 22 (0,97) |
| 31 | Romania | 76,72% | 0 | 1 | 0,99 | 0,01 | 12 (0,08) 22 (0,90) |
| 30 | Portugal | 76,39% | 0 | 1 | 0,96 | 0,04 | 12 (0,33) 22 (0,67) |
| 13 | Spain | 75,25% | 0 | 1 | 0,98 | 0,02 | 12 (0,15) 22 (0,85) |
| 36 | USA | 74,00% | 0 | 1 | 0,97 | 0,03 | 12 (0,21) 22 (0,79) |
| 2 | Australia | 73,87% | 0,04 | 0,96 | 0,93 | 0,07 | 3 (0,07) 12 (0,09) 22 (0,84) |
| 34 | Turkiye | 72,20% | 0 | 1 | 0,98 | 0,02 | 12 (0,13) 22 (0,87) |
| 35 | Ukraine | 72,18% | 0 | 1 | 1 | 0 | 12 (0,02) 22 (0,97) |
| 14 | France | 71,68% | 0 | 1 | 0,96 | 0,04 | 12 (0,32) 22 (0,68) |
| 16 | Greece | 69,61% | 0,06 | 0,94 | 0,85 | 0,15 | 3 (0,25) 12 (0,16) 22 (0,58) |
| 5 | Brazil | 68,57% | 0 | 1 | 1 | 0 | 12 (0,00) 22 (0,98) |
| 25 | Malaysia | 67,60% | 0,03 | 0,97 | 0,96 | 0,04 | 3 (0,04) 12 (0,05) 22 (0,90) |
| 11 | Germany | 67,20% | 0 | 1 | 0,99 | 0,01 | 12 (0,10) 22 (0,90) |
| 19 | Iran | 66,99% | 0 | 1 | 0,99 | 0,01 | 12 (0,03) 22 (0,96) |
| 8 | Chile | 66,11% | 0 | 1 | 0,98 | 0,02 | 12 (0,13) 22 (0,86) |
| 6 | Canada | 65,50% | 0,03 | 0,97 | 0,96 | 0,04 | 3 (0,07) 12 (0,02) 22 (0,91) |
| 9 | Columbia | 65,13% | 0 | 1 | 0,99 | 0,01 | 12 (0,03) 22 (0,95) |
| 21 | Italy | 61,52% | 0,06 | 0,94 | 0,92 | 0,08 | 3 (0,04) 12 (0,21) 22 (0,75) |
| 1 | Argentina | 60,52% | 0 | 1 | 0,99 | 0,01 | 12 (0,04) 22 (0,95) |
| 27 | Peru | 56,28% | 0 | 1 | 0,99 | 0,01 | 12 (0,05) 22 (0,89) |

In this table, countries are listed according to their efficiency scores in the first column. Accordingly, 4 countries are efficient (Austria, Denmark, Indonesia and Japan). Turkiye is ranked 25th among 38 countries with an efficiency score of 72%.

In addition, the table also reports that which weights countries assign to which inputs and outputs in reaching their efficiency scores and which countries they should refer to in what proportion in order to be efficient. Accordingly, for example, while Turkey assigns all weight to "stringency measures" among its inputs, it assigns weight to the "recovery" in outputs. In other words, Turkiye has reached the highest efficiency value with these weights, which shows that it is in a relatively better position than other countries in these.

On the other hand, the shortest path Turkiye can follow to become an efficient country, in other words,

the most suitable reference for Turkey, is Denmark by 13% and Japan by 87%.

### 4.3.2. Clustering Countries w.r.t. Their Structural Similarities

**Demographic and Economic Variables**

First, analyzing the correlations between structural variables; 2 variables from Economic Characteristics and 2 criteria from Demographic indicators were selected which is shown in the **Table 3** below. Then, cluster analysis was performed on these 4 variables.

**Table 3. Structural (Economic and Demographic) Indicators and Criteria for Clustering**

| Structural Indicators for Clustering | Criteria |
|---|---|
| Capacity indicators: Economic and Infrastructure | Current health expenditure (% of GDP) |
| | GDP per capita (current US$) |
| Demographic Indicators | Population Density |
| | Population ages 65 + (%) |

Using these structural indicators/scores of the countries and implementing the cluster methodology given in (4)-(5), via SPSS program, constructed dendogram is given below.

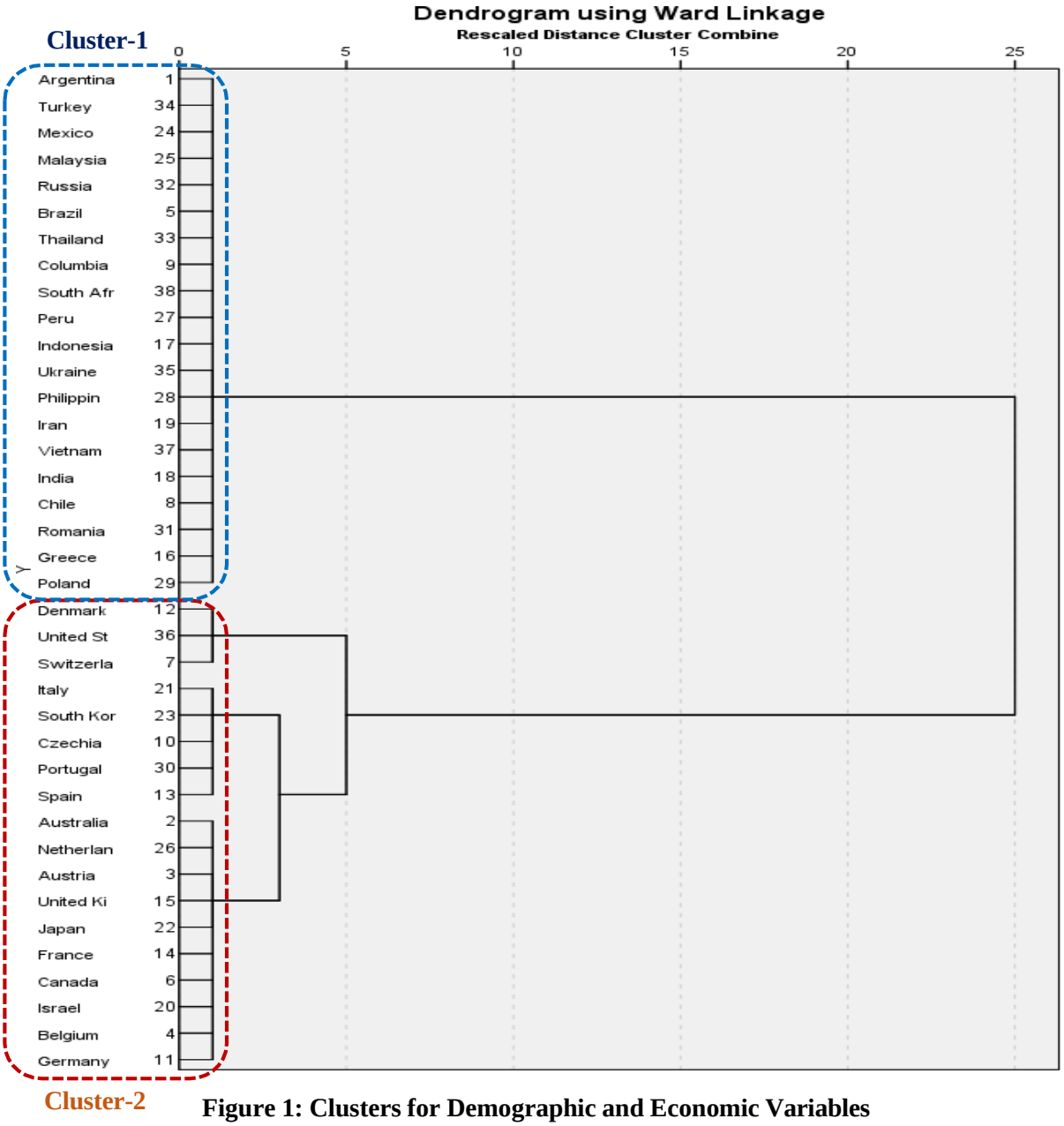


**Figure 1: Clusters for Demographic and Economic Variables**

Clusters were shown on the dendogram in Figure 1. According to cluster analysis, our sample is divided into two distinct groups/clusters with respect to "demographic and capacity/economic" structural variables. The first cluster consists of 20 countries that can be considered "less developed/developing" countries (Argentina, Turkey, Mexico, etc.) compared to others; while the second group/cluster consists of 18 developed countries that are clearly different from Cluster 1 according to the data; both clusters are shown in the dendogram.

**Cultural Variables**

In this context we use "The Inglehart-Welzel World Cultural Map" which is extracted from World Values Survey (WVS) – wave 7 (2017-2022), by political scientists Ronald Inglehart and Christian Welzel (Inglehart & Welzel. 2005) and presents empirical evidence of massive cultural change and the persistence of distinctive cultural traditions. The illustration of this map is presented in Figure 2.

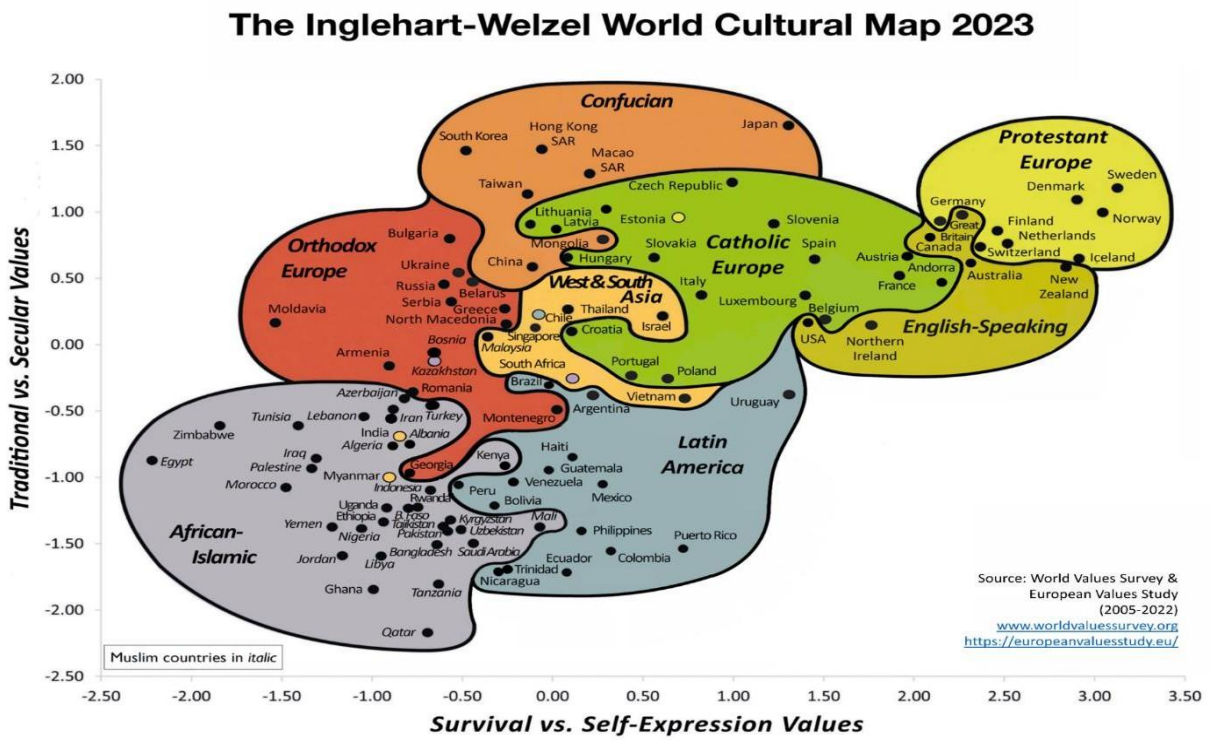


**Figure 2. Clustering Countries w.r.t. Structural Similarities: Cultural Variables**

**Source:** The Inglehart-Welzel World Cultural Map - World Values Survey 7 (2022): www.worldvaluessurvey.org

This map asserts that there are two major dimensions of cross-cultural variation in the world:

1) Traditional values versus Secular-rational values: *Traditional values* emphasize the importance of religion, parent-child ties, deference to authority and traditional family values; while *secular-rational values* have the opposite preferences to the traditional values. These societies place less emphasis on religion, traditional family values and authority.

2)

3) Survival values versus Self-expression values: Here *survival values* place emphasis on economic and physical security. It is linked with a relatively ethnocentric outlook and low levels of trust and tolerance; *self-expression values* give high priority to environmental protection, growing tolerance of foreigners, etc. and rising demands for participation in decision-making in economic and political life.

4)

The two dimensions have been created by running factor analysis over a set of indicators. For example, while societies that have high scores in Traditional and Survival values are Zimbabwe, Morocco, Jordan, Bangladesh; societies with high scores in Traditional and Self-expression values are the U.S., most of Latin America, Ireland. On the other hand, societies with high scores in Secular-rational and Survival

values: Russia, Bulgaria, Ukraine, Estonia; and, societies with high scores in Secular-rational and Self-expression values: Sweden, Norway, Japan, Benelux, Germany, France, Switzerland, Czech Republic, Slovenia, and some English-speaking countries.

The global cultural map (Figure 2) shows how scores of societies are located on these two dimensions. Moving upward on this map reflects the shift from Traditional values to Secular-rational and moving rightward reflects the shift from Survival values to Self-expression values.

Using these cultural indicators/scores of the countries (extracted from the data base of this chart for our sample) and implementing the cluster methodology given in (4)-(5), via SPSS program, constructed dendogram is given below.

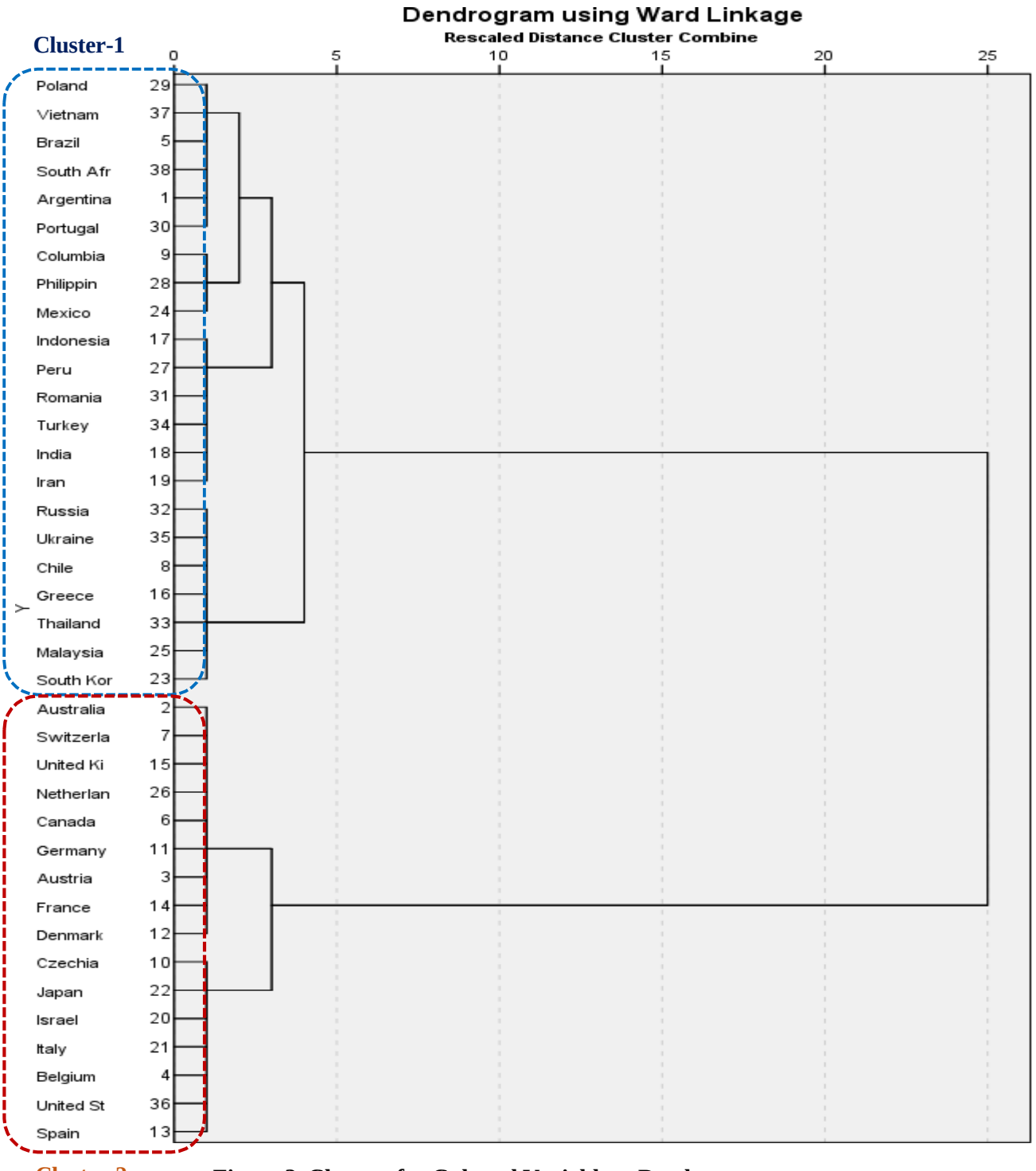


**Figure 3. Clusters for Cultural Variables - Dendogram**

Similar to the dendogram given in Figure 1, two clusters were formed in the cultural analysis and the countries included in these clusters are shown on the figure. Cultural Class/Cluster 1 consists of more traditional/conservative countries (22 countries); while Cluster 2 consists of more rational secular countries (16 countries).

### 4.3.3. Efficiency Scores with respect to Clusters

The average efficiency scores of the countries were calculated and compared on a cluster basis. The efficiency score averages for each cluster are given comparatively in the table below.

**Table 4:** Efficiencies with respect to Clusters

| Efficiencies w.r.t. Clusters/Classes | Number | Min Eff. | Max Eff. | Mean Eff. | St.Dev. | No. of Efficient Countries |
|---|---|---|---|---|---|---|
| Whole Sample | 38 | 0,56 | 1,00 | 0,7813 | 0,1198 | 4 |
| Structural Cluster-1 | 20 | 0,56 | 1,00 | 0,7532 | 0,1108 | 1 |
| Structural Cluster-2 | 18 | 0,62 | 1,00 | 0,8107 | 0,1251 | 3 |
| Cultural Cluster-1 | 22 | 0,56 | 1,00 | 0,7655 | 0,1178 | 1 |
| Cultural Cluster-2 | 16 | 0,62 | 1,00 | 0,8031 | 0,1230 | 3 |

The efficiency scores of developing countries developed (namely, Cluster 1 in structural character's clustering given in Figure 1) took place lower than those of developed (namely, class 2 in structural character's clustering given in Figure 1) countries; as the mean values of 0,75 and 0,78, respectively. Likewise, more traditional and less secular countries (namely, Cluster 1 in cultural character clustering given in Figure 3) have lower efficiency scores than the Cluster 2; as the mean values of 0,7655 and 0,8031, respectively. Structurally developed (which have higher income and better health infrastructure) and culturally secular / rational countries have been more efficient despite lower restrictions. It is seen that, despite higher number of cases, they have achieved this by providing more testing and improvement. The less developed countries, on the other hand, tried to keep the number of cases low by focusing more on restrictions.

However, in general, the efficiency scores are lower than those of developed (namely, class 2 in structural character's clustering) countries. Likewise, more traditional and less secular countries (namely, 1st class in cultural character clustering) have lower efficiency scores than the other group.

All these results were also confirmed by appropriate non-parametric statistical tests.

## Conclusion

In this study, efficiencies of countries against pandemic between the periods of February, 20, 2020 and February, 20, 2022 (before spread of vaccination) has been measured and the linkage between these efficiencies and the structural characteristics (cultural and socio-economic properties) of the countries tried to be find out. For this aim, first efficiency analysis is implemented via Data Envelopment Analysis (DEA) method. Then, a clustering analysis technique (Ward's Method) has been used to obtain clusters with respect to structural characteristics of the countries. Finally, the link between efficiency and structural characteristics of the countries are presented.

The results reveal that structurally developed (which have higher income and better health infrastructure) and culturally secular / rational countries have higher efficiency while struggling against Covid-19. It is seen that, despite higher number of cases, they have achieved this by providing more testing and recovery. The less developed countries (or traditional countries), on the other hand, tried to keep the number of cases low by focusing more on restrictions (more stringency).

In future studies, different structural chracteristics of countries can also be used in performance evaluation in COVID or disaster response. In this way, it will be possible to make multi-faceted evaluations and take more effective precautions.

## References


Acar, E., Gökkaya, D., & Şenol, O. (2023). Efficiency analysis of middle-income countries in terms of health indicators for the COVID process. *Manas Sosyal Araştırmalar Dergisi*, *12*, 300-317.

Aras, İ.A. (2023). "Gelir Gruplarına Göre COVID-19 Pandemisinde Sağlık Sistem Performansı Etkinliğinin Ölçülmesi", *Dicle Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 13(26), 731-746.

Aydin, N., & Yurdakul, G. (2020). Assessing countries' performances against COVID-19 via WSIDEA and machine learning algorithms. *Applied Soft Computing*, *97*, 106792.

Banker, R.D., A. Charnes and W.W. Cooper (1984), "Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis", *Management Science*, 30, 1078-1092.

Bayram, G., & Yurtsever, Ö. (2021). Efficiency evaluation of European countries in terms of COVID-19. *International Journal of Advances in Engineering and Pure Sciences*, *33*(3), 366-375.

Charnes, A., W.W. Cooper and E. Rhodes (1978), "Measuring the Efficiency of Decision Making Units", *European Journal of Operational Research*, 2, 429-444.

Inglehart, R & C. Welzel. 2005. Modernization, Cultural Change and Democracy: The Human Development Sequence. New York: Cambridge University Press

Jamison, D. T., Lau, L. J., Wu, K. B., & Xiong, Y. (2020). Country performance against COVID-19: rankings for 35 countries. *BMJ global health*, *5*(12).

Kaya, M. and Yenimahalleli Yaşar, G. (2024). "OECD Ülkelerinde COVID-19 Pandemisiyle Mücadele: Kaynak Verimliliği Açısından Bir Karşılaştırma", *Verimlilik Dergisi*, 58(4), 501-520.

Kaya, S. K. (2020). Evaluation of the Effect of COVID-19 on Countries' Sustainable Development Level: A comparative MCDM framework. *Operational Research in Engineering Sciences: Theory and Applications*, *3*(3), 101-122.

Küçükaycan, D. (2021). "Küresel Kamusal Mal Perspektifinden COVID-19 Pandemisiyle Mücadelede Evrensel Sağlık Kapsayıcılığı ve OECD Ülkelerinin Performansının Araştırılması (Universal Health Coverage Combating COVID-19 Pandemic from Global Public Goods Perspective and Researchıng of OECD Countrıes' Performance)", *Maliye Dergisi*, 181, 234-263.

Lupu, D., & Tiganasu, R. (2022). COVID-19 and the efficiency of health systems in Europe. *Health Economics Review*, *12*(1), 14.

Polat, E. (2023). Determining Efficiency of 15 OECD Countries Coping with Covid-19 using Data Envelopment Analysis after 2 Years of Pandemic. *Cumhuriyet Science Journal*, *44*(4), 816-824.

Romesburg, H.C. *Cluster Analysis for Researchers*. Lulu Press, 2004.

Sel. A. (2021). "COVID 19 Pandemisinde Sağlık Sistemi Gelişmelerinin Etkinliğinin Ölçülmesi: G-20 Üzerine Bir İnceleme", *Kırklareli Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi,* 10(2), 181-202.

Selamzade, F., Ersoy, Y., Ozdemir, Y., & Celik, M. Y. (2023). Health efficiency measurement of OECD countries against the COVID-19 pandemic by using DEA and MCDM methods. *Arabian Journal for Science and Engineering*, *48*(11), 15695-15712.

Shirouyehzad, H., Jouzdani, J., & Khodadadi Karimvand, M. (2020). Fight against COVID-19: a global efficiency evaluation based on contagion control and medical treatment. *Journal of applied research on industrial engineering*, *7*(2), 109-120.

Sotoudeh-Anvari, A. (2022). The applications of MCDM methods in COVID-19 pandemic: A state of the art review. *Applied Soft Computing*, *126*, 109-238.

Wu, J. S. (2023). Measuring efficiency of the global fight against the COVID-19 pandemic. *Digital Health*, *9*, 20552076231197528.

Yüksel, O. (2021). "Comparison of Healthcare System Performances in OECD Countries", *International Journal of Health Services Research and Policy*, 6(2), 251-261.

# GENİŞLETİLMİŞ ÖZET

## Problem ve Kapsam

İlk olarak 8 Aralık 2019'da Çin'in Wuhan kentinde doğrulanan koronavirüs, diğer adıyla COVID-19, tüm dünyaya hızla yayılmış ve ülkelerin sağlık, sosyo-ekonomik ve çevresel koşullarını kötüleştirmiştir. Bu hastalığın yayılımı, Dünya Sağlık Örgütü tarafından 11 Mart 2020'de "pandemi" olarak ilan edilmiştir. Pandeminin yayılma hızını ve insan/toplum sağlığı üzerindeki olumsuz etkilerini azaltmak için tüm dünyada bazı önlemler, kısıtlayıcı politikalar ve sağlık sistemlerinin olağanüstü çabaları yoluyla karşı bir mücadele başlatılmıştır. Ancak ekonomik, sosyo-kültürel vb. farklılıklar nedeniyle bazı ülkeler daha iyi performans gösterirken, diğerleri göstermemiştir. Bu nedenle pandemi ile mücadelede hangi ülkelerin daha iyi performans gösterdiğini ve bunun nedenlerini / bu ülkelerin özelliklerini belirlemek cevaplanması gereken çok önemli bir sorudur.

Bu bağlamda, bu çalışma 20 Şubat 2020- 20 Şubat 2022 (aşılamanın yayılmasından önce) dönemleri arasındaki pandemiye karşı ülkelerin politika / yönetim etkinliklerini ve performanslarını değerlendirmektedir. Aynı zamanda verilerden, ülkelerin performansları ile yapısal özellikleri (kültür ve sosyo-ekonomik özellikler) arasındaki bağlantıya dair bazı ipuçları bulunmuştur. Çalışmanın katkısı da özellikle bu konudadır; Covid-19'a karşı bir performans değerlendirmesinde tüm bu yönleri aynı anda inceleyen başka bir çalışmaya rastlanmamıştır.

## Metodoloji

Etkinlik analizi, homojen bir karar alma birimleri kümesinin (burada ülkeler) göreceli verimliliklerini ölçmek için çok faktörlü bir etkinlik analizi modeli olan Veri Zarflama Analizi (VZA) yöntemi ile uygulanmaktadır. Çalışmada bu analiz, tüm analiz dönemindeki ortalama değerler üzerinde yürütülmüştür. Daha sonra, etkinlik skorları ile ülkelerin yapısal özellikleri arasındaki bağlantıları daha doğru bir şekilde gözlemlemek için bir kümeleme analizi tekniği (Ward Yöntemi) kullanıldı.

## Veri: Örneklem ve Değişkenler

İlk örneklem için veriler 39 ülkeden oluşmaktadır. Bu ülkeler, çalışmada kullanılması planlanan tüm mevcut verilere sahip olan ve pandemide toplam küresel vakaların önemli bir yüzdesini (bireysel ülke düzeyinde 3 Milyondan fazla kümülatif vaka veya daha fazlası) oluşturan ülkeler arasındadır. Kasım 2022 itibarıyla küresel kümülatif vakaların %88'ini oluşturuyorlardı (kaynak: ourworldindata.org).

Bu ülkeler (toplam kümülatif vakaların azalan sırasına göre): Amerika Birleşik Devletleri, Hindistan, Fransa, Almanya, Brezilya, Güney Kore, Birleşik Krallık, İtalya, Japonya, Rusya, Türkiye, İspanya, Vietnam, Avustralya, Arjantin, Hollanda, Tayvan, İran, Meksika, Endonezya, Polonya, Kolombiya, Ukrayna, Portekiz, Avusturya, Yunanistan, Malezya, Şili, İsrail, Tayland, Belçika, Kanada, İsviçre, Peru, Çekya, Güney Afrika, Filipinler, Danimarka ve Romanya. Tayvan, gerekli tüm verilerin eksikliği nedeniyle hariç tutulmuştur. Bu nedenle, son örneklem 38 ülkeden oluşmaktadır. En güncel literatürde yaygın olarak kullanılan politik, demografik, kapasite, sosyo-ekonomik ve Covid- 19 göstergelerini hesaba katan çok çeşitli kriterler seçilmiştir. İlk veri kategorisi Covid-19'a karşı performans ölçümleri, diğeri ise ülkelerin sosyal ve ekonomik yapılarını karakterize edenlerdir. Ülkeler yapısal özelliklerine (sosyo-ekonomik, demografik) ve kültürel harita puanlarına göre gruplara ayrılmıştır.

## Modeller ve Değişkenler: Girdiler ve Çıktılar (Kriterler)

Burada, değişkenlerin tüm değerleri ülke nüfuslarına bölünerek, ülke büyüklüklerinin oluşturabileceği performans sapması kontrol edilmiştir. Kullanılan girdi-çıktı değişkenleri; Ortalama Politika Sıkılığı Endeksi, Toplam Vaka / Nüfus; Toplam Testler / Nüfus; Toplam Kurtarılanlar / Nüfus olarak belirlenmiştir. Sağlık ve ekonomik sistemi yapısal özellikleri açısından kümeleme yapılırken ülkeler; Sağlık Harcaması, Bin Kişi Başına Hastane Yatağı, Nüfus yoğunluğu, 65 yaş üstü nüfus (%), Kardiyovasküler Ölüm Oranı, Diyabet Yaygınlığı, Sigara içen yetişkinlerin payı, Aşırı Yoksulluk, Kişi Başına GSYİH, İnsani gelişme endeksi puanları açısından gruplandırılmıştır.Kültürel açıdan puanlama ve kümelenmesi ise Inglehart-Welzel Dünya Kültür Haritası - Dünya Değerleri Anketi 7. dalga (2023)'den alınmıştır. Bu çalışmada her ülke için geleneksel değerler, rasyonel-laik; hayatta kalma/kendi koruma ile kendini ifade etme değerleri arasında karşılaştırmalar ve puanlar mevcuttur. Bu kümelenmelerin etkinlik skorları ortalamalarının karşılaştırması yoluyla çeşitli çıkarımlara ulaşılmıştır. Böylelikle ülkelerin gelişmişlik farklarının ve / veya pandemi döneminde uygulanan kısıtlama tedbirleri vb. kurallara uyma bakımından toplumların sahip oldukları kültürel değerlerin etkisi dolayısıyla etkinlikte bir fark oluşturup oluşturmadığı araştırılmıştır.

## Sonuçlar

Sonuçlar, güçlü sağlık sistemlerine ve hükümet politikalarına sahip ülkelerin Covid-19 ile mücadele ederken daha yüksek etkinliğe sahip olduğunu ortaya koymaktadır. Daha açık bir şekilde, sonuçlar esas olarak şunları ifade etmektedir; yapısal olarak gelişmiş (daha yüksek gelire ve daha iyi sağlık altyapısına sahip) ve kültürel olarak laik/rasyonel ülkeler daha etkin olmuştur. Daha yüksek vaka sayılarına rağmen bunu daha fazla test ve iyileşme sağlayarak başardıkları görülmektedir. Öte yandan daha az gelişmiş ülkeler, kısıtlamalara (sıkılık) daha fazla odaklanarak vaka sayılarını düşük tutmaya çalışmışlardır.