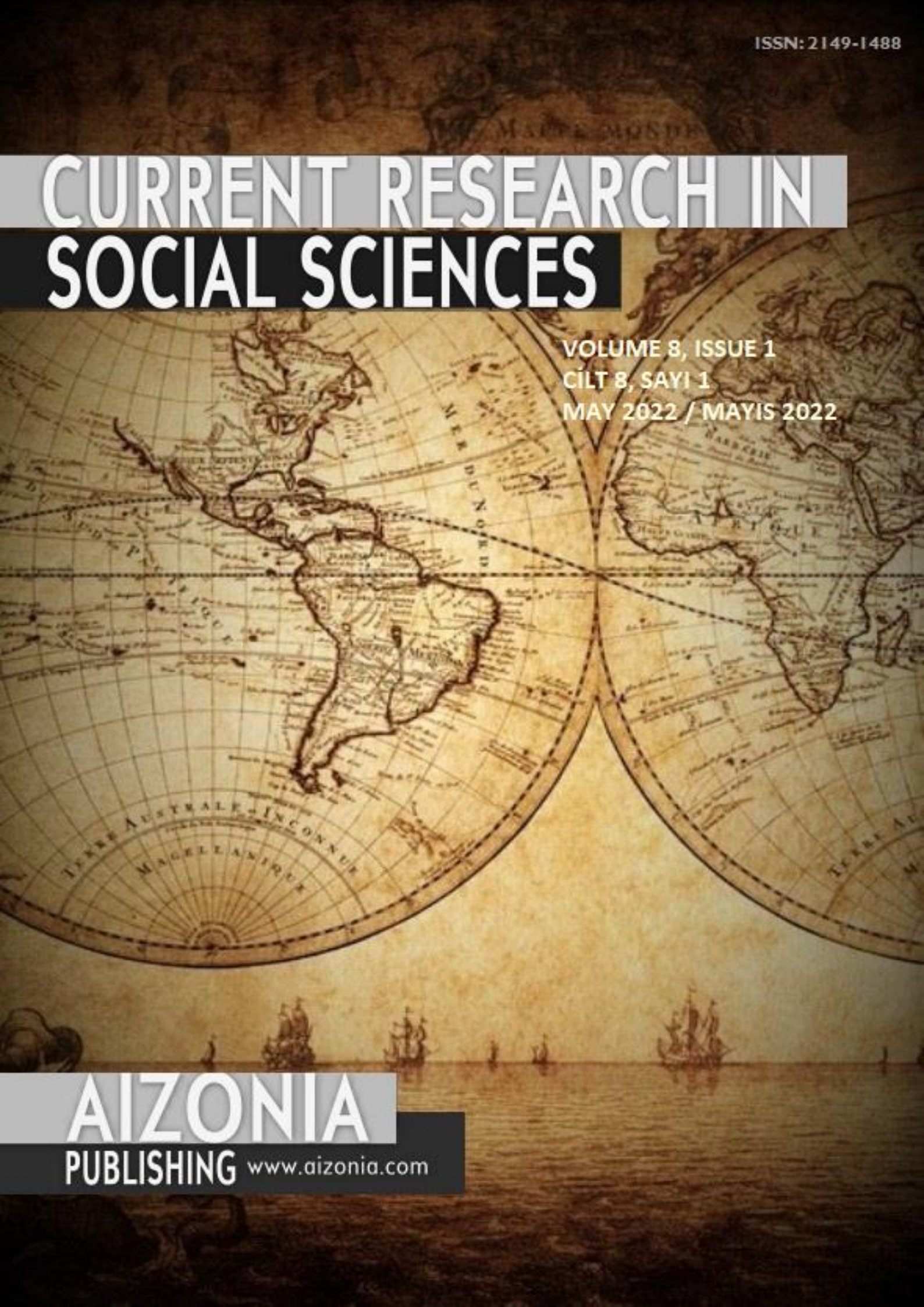
ISSN: 2149-1488

CURRENT RESEARCH IN SOCIAL SCIENCES

VOLUME 8, ISSUE 1
CİLT 8, SAYI 1
MAY 2022 / MAYIS 2022



AIZONIA
PUBLISHING www.aizonia.com

ISSN: 2149-1488

CURRENT RESEARCH IN SOCIAL SCIENCES

Volume 8, Issue 1, May 2022

Cilt 8, Sayı 1, Mayıs 2022

Aizonia Publishing

www.aizonia.com

Current Research in Social Sciences

Volume: 8, Issue: 1, 2022 / Cilt: 8, Sayı: 1, 2022
Publishing Date / Yayın Tarihi: 31.05.2022

It is an international, semi-annual (in May and November) peer-reviewed published online journal. The official language of the journal is English. The responsibility of articles and scientific papers published in the journal belongs to their authors. The journal was indexed in international indexing sources such as TÜBİTAK ULAKBİM Social and Human Sciences Database, J-Gate, Advanced Science Index, Directory of Research Journals Indexing, Elektronische Zeitschriftenbibliothek (EZB) and Research Bible.

Uluslararası, altı (6) ayda bir yayınlanan (Mayıs ve Kasım aylarında) hakemli bir elektronik dergidir. Derginin yayın dili İngilizcedir. Dergide yayınlanan makale ve bilimsel yazıların sorumluluğu yazarlarına aittir. Dergi TÜBİTAK ULAKBİM Sosyal ve Beşeri Bilimler Veritabanı, J-Gate, Advanced Science Index, Directory of Research Journals Indexing, Elektronische Zeitschriftenbibliothek (EZB) ve Research Bible gibi uluslararası indekslerde taranmaktadır.

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CONTENTS / İÇİNDEKİLER

EDITORIAL

Dear Readers,

We have introduced the first issue of 8th volume of the journal published in May 2022.

The acceptance rate of Current Research in Social Sciences Volume 8, Issue 1 was 27.3%, and I would like to thank to the authors, referees, members of the editorial board and editors who took part in the publication process of the journal. See you in our next issues.

Greetings and regards.

Asst. Prof. Dr. Duygu TÜRKOĞLU
University of Health Sciences Turkey
Department of Management and Organization

EDİTÖRDEN

Sevgili Okurlar,

2022 yılı mayıs ayında yayınlanan dergimizin sekizinci cildinin birinci sayısını sizlere sunmuş bulunuyoruz.

Current Research in Social Sciences 8. Cilt 1. Sayısının kabul oranı %27.3 olup, derginin yayın sürecinde yer alan yazar, hakem, yayın kurulu üyeleri ve editör arkadaşlarıma teşekkür etmek isterim. Sonraki sayılarımızda görüşmek üzere.

Selam ve saygılarımla.

Dr. Öğr. Üyesi Duygu TÜRKOĞLU
Sağlık Bilimleri Üniversitesi
Yönetim ve Organizasyon Bölümü

ORIGINAL RESEARCH

Curr Res Soc Sci (2022), 8(1) • 1-28

Energy Consumption Trends before and during the Covid-19 Pandemic: An Entropy-Based PROMETHEE Analysis

Covid-19 Pandemisi Öncesi ve Sırasındaki Enerji Tüketim Trendleri: Entropi Tabanlı PROMETHEE Analizi

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Abstract

Renewable energy sources have a crucial role in decreasing reliance on fossil fuels. In the literature, there is a need for new studies on the evaluation of energy use preferences and policies of countries before and during the Covid-19 pandemic. In order to fill this gap, the study aimed to compare and evaluate 36 countries through Entropy-based PROMETHEE methods using TheGlobalEconomy.com indicators. As a result of Entropy, while the criterion with the highest importance is the gasoline consumption criterion with a value of 14.12%, the criterion that follows these criteria in order are the fossil fuels electricity generation (12.25%); coal consumption (11.8%); coal imports (10.52%); renewable power generation (10.29%). According to the PROMETHEE results, Sweden ranked first and is a good performer in almost all the indicators. In addition, the first 10 countries in the ranking are the European Union countries. The novelty of the study is that it provides an important review of the current literature on energy and that 36 countries with significant economic power from almost all continents are evaluated in terms of energy consumption and preferences at both pre-pandemic and pandemic conditions.

Keywords: Renewable Energy, Environmental Management, Entropy, PROMETHEE, Covid-19.

Öz

Yenilenebilir enerji kaynakları, fosil yakıtlara olan bağımlılığın azaltılmasında önemli bir role sahiptir. Literatürde Covid-19 pandemisi öncesi ve sırasında ülkelerin enerji kullanım tercihleri ve politikalarının değerlendirilmesine yönelik yeni çalışmalara ihtiyaç duyulmaktadır. Bu boşluğu doldurmak için çalışma, TheGlobalEconomy.com göstergelerini kullanarak Entropi tabanlı PROMETHEE yöntemleriyle 36 ülkeyi karşılaştırmayı ve değerlendirmeyi amaçlamıştır. Entropi sonucunda en yüksek öneme sahip kriter %14,12 değeri ile benzin tüketim kriteri iken, bu kriterleri sırasıyla takip eden kriter fosil yakıtlardan elektrik üretimi (%12,25); kömür tüketimi (%11,8); kömür ithalatı (%10.52); yenilenebilir enerji üretimi (%10,29). PROMETHEE sonuçlarına göre İsveç ilk sırada yer almaktadır ve hemen hemen tüm göstergelerde iyi bir performans sergilmektedir. Ayrıca, sıralamada ilk 10 ülke Avrupa Birliği ülkelerinden oluşmaktadır. Çalışmanın literatüre sunduğu yenilik, güncel enerji literatürüne önemli bir inceleme sunması ve hemen hemen tüm kıtalardan önemli ekonomik güce sahip 36 ülkenin hem pandemi öncesi hem de pandemi koşullarında enerji tüketimi ve tercihleri açısından değerlendirilmesidir.

Anahtar Kelimeler: Yenilenebilir Enerji, Çevre Yönetimi, Entropi, PROMETHEE, Covid-19.

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Article Info / Makale Bilgileri:

Received / Gönderim: 09.02.2022 Accepted / Kabul: 13.04.2022

To cite this article / Atıf için:

Özkaya, G. (2022). Energy consumption trends before and during the Covid-19 pandemic: An entropy-based PROMETHEE analysis. *Curr Res Soc Sci, 8*(1), 1-28.

To link to this article / Bağlantı için:

http://dx.doi.org/10.30613/curesosc.1071005

Introduction

According to the International Energy Agency (IEA)'s "major slight" plan for zero-carbon energy sources, wind and solar power will account for 40% of global energy production. TThe COVID-19 pandemic lockdown has had a tremendous impact on the environment. As demonstrated in Table 1, air quality has improved as a result of significant reductions in carbon dioxide and nitrogen oxide emissions, as well as an increase in related ozone (O3), as compared to 2019 levels for the same time period (Rita et al., 2021).

Table 1

COVID-19 Lockdown Period Emission Reductions for the Years 2019–2020

Sn	Emission	% Reduction/increase
1	CO_2	25↓
2	NO	30↓
3	O_3	30↑

↓- decrease, ↑-increase.

Today, fossil fuels provide 80 percent of global energy. Despite this superiority of fossil fuels in terms of global energy supply, rising air pollution in wealthy industrial nations, the negative implications of global warming, and the desire to reduce reliance on foreign energy sources have raised interest in renewable energy sources. Renewable energy sources are crucial for decreasing reliance on fossil fuels like coal, oil, and natural gas. When global energy output is compared across various energy sources, the renewable energy sector has had the largest yearly average rise over the previous fifty years. As a result of this interest, the yearly average rise in renewable energy supply has been around five times that of other energy sources during the previous fifty years. Globally, energy generated from renewable energy sources other than hydro and biofuels increased by 9.4 percent each year throughout this time. Considering that the annual average increase in the energy produced from oil in the same period was only 1.2 percent, it is clear that renewable resources, especially wind and solar, have been increasingly used in energy production. When the last 40-year period is compared, coal production in Europe decreased by 52.5 percent, while in North America the decrease was 11.2 percent and the Commonwealth of Independent States, including Russia (CIS: Azerbaijan, Belarus, Armenia, Kazakhstan, Kyrgyzstan, Moldova, Uzbekistan, Russia and Tajikistan) was 27.2 percent. The Commonwealth of Independent States and North America are locations abundant in alternative fossil fuels. Therefore, this had a much greater effect on this reduction than environmental awareness. While coal production decreased in the West and Russia over the same era, it increased significantly in the Asia-Pacific area (Enerdata, 2020; IEA, 2020; Looney, 2020).

The worldwide recession in the energy industry has resulted in considerable revenue losses for the majority of energy corporations. Due to poor demand and low pricing for its goods, including oil, gas, coal, and power, the energy industry has been suffering a double loss. The average price of oil decreased dramatically. For the first time in history, West Texas Intermediate prices fell below zero. LNG prices in the European and Asian markets fell to all-time lows. Natural gas prices fell negative in the United States, where storage space was full. Coal suffered less damage as its supply chain was less affected by logistical constraints than oil and gas. The combination of low-cost gas and declining demand has resulted in a one-third fall in wholesale energy costs. Market prices for electricity fell below zero in the United States and some countries in Europe, including Belgium, Denmark, Finland, France, Germany, Sweden and Switzerland (IEA, 2020).

The rapid recovery above the expectations behind the contraction in the economies due to Covid-19 increased the energy demand significantly in 2021. The inadequacy of the present energy supply to fulfill the increased energy demand resulted in considerable rises in both oil and natural gas prices. When 2022 is considered, the

growth in natural gas prices in EU nations demonstrated that it will continue to be a significant component in inflation in 2022, as it was in 2021. The World Bank published the October 2021 issue of its Commodity Markets Outlook Report with the title "Urbanization and Commodity Demand". According to the report, energy costs increased in the third quarter of 2021 and are projected to continue elevated in 2022. In the report; It was noted that the energy commodity price index consisting of oil, natural gas and coal is expected to increase by 83.4 percent this year compared to last year, while the index consisting of non-energy commodity prices such as agricultural products, metals and minerals is expected to increase by 31 percent. The research claimed that although the energy commodity price index is predicted to rise by 2.3 percent next year, the non-energy commodity price index is likely to fall by 2.3 percent. In the report, it is predicted that the price of crude oil per barrel will increase by 69.7 percent compared to last year and will reach an average of $ 70, while it is expected to reach an average of $ 74 in 2022 with an increase of 5.7 percent (World Bank, 2020).

Renewable energy is energy derived from sources in the natural environment that may be accessed continuously or repetitively. Renewable energy sources include the sun, wind, biomass, geothermal, and wave energy. Renewable energy is also described as energy derived from natural resources that is environmentally sustainable. In contrast to fossil fuels, these resources are limitless throughout time and serve as a viable alternative to non-renewable energy sources such as coal, gasoline, and natural gas (Sharif et al., 2020).

Renewable energy is regarded to be the fastest expanding industry worldwide, with more finance being allocated to renewable energy projects than ever before. As the need for clean, sustainable energy increases and renewable energy technology progress, larger and more complicated projects are being constructed (aenerji, 2021). Table 2 summarizes many of them.

Table 2

The Largest and Most Expensive Renewable Energy Projects in the World

Project name and region	**Project type**	**Cost (billion dollars)**
Wudongde Hydroelectric Power Plant / China	Hydroelectric	15.4
Inga 3 / Democratic Republic of the Congo	Hydroelectric	14
Keeyask Hydroelectric Power Plant / Canada	Hydroelectric	8.7
Hornsea 2 Renewable Energy Project / United Kingdom	Offshore wind	7.8
Ghana Wave Power Project, Ghana	Wave	7.5
Ulanqab Wind Farm / China	Terrestrial wind	6.2
Triton Knoll / United Kingdom	Offshore wind	6
Leh and Kargil Solar Energy Projects / India	Solar PV	6
Mohammed bin Rashid al-Maktoum Solar Park Phase IV / Dubai	Solar CSP	4.295
Shek Kwu Chau Energy from Waste / Hong Kong	Energy from waste	4

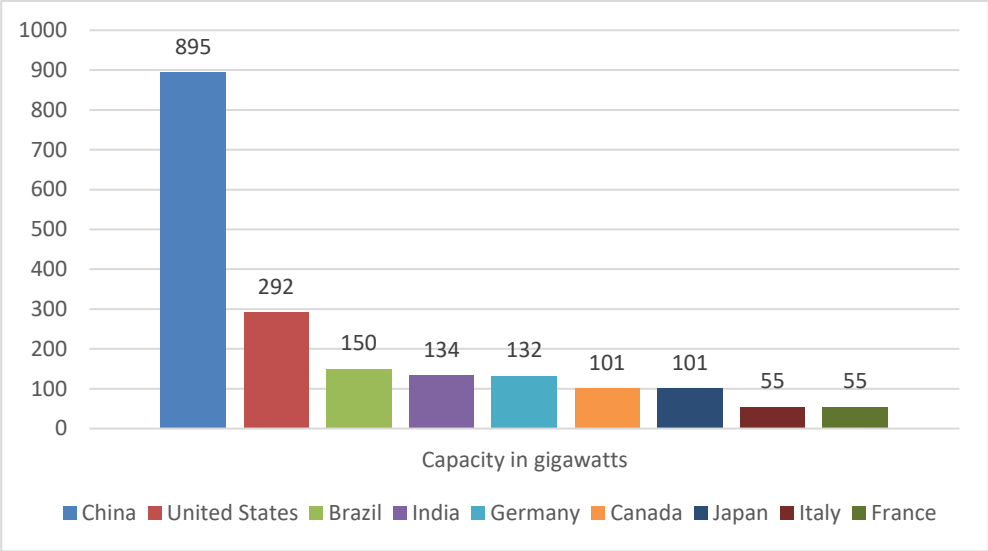
The world's leading nations in terms of installed renewable energy capacity in 2020 are shown in Figure 1 (Statista, 2021).

Despite the pandemic, renewable energy sources are the only energy source with increased demand in 2020, while the consumption of all other fuels has decreased in usage. Highlights from the report are as follows: In 2020, annual renewable capacity additions increased by 45% to almost 280 GW – the highest annual increase since 1999. Solar PV development continued to break records, reaching 162 GW, almost 50% higher than the pre-pandemic level in 2019. Global wind capacity additions increased by more than 90% to 114 GW in 2020. While the annual market growth rate may slow in 2021 and 2022, it is still expected to be 50% above the 2017-2019 average. With more policy support and reduced PV costs, Europe's capacity growth is expected to accelerate, driven by the evolving Power purchase agreement (PPA). The updated forecast for the United States

is more optimistic due to federal tax credit extensions. The new US emissions reduction targets and infrastructure proposal, if adopted, will accelerate the expansion of renewable energy beyond 2022. When 2021 is evaluated, Turkey's total installed power in renewable energy exceeded 97 thousand MW, while the share of natural gas in electricity generation decreased to 25 percent (Ernst&Young, 2020).

Figure 1

Leading Countries in Renewable Energy Capacity Installation in 2020 (in gigawatts)

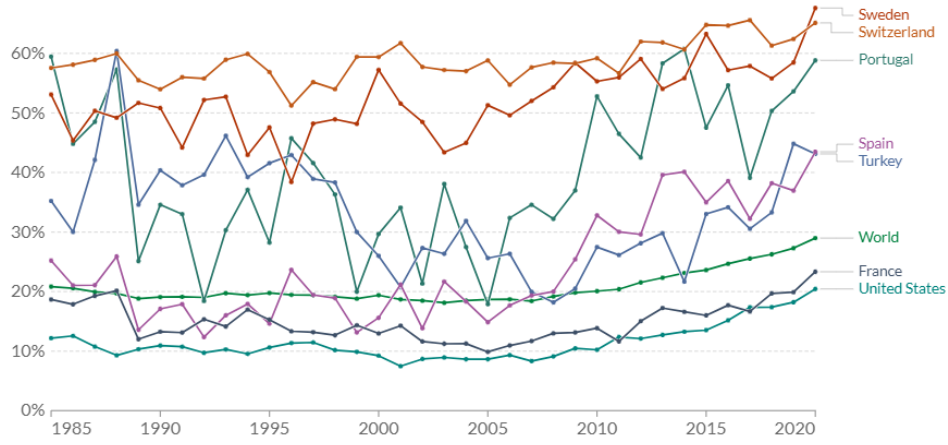


While the amount of electricity generated by renewable energy sources in Europe surpassed the amount generated by fossil fuels for the first time in 2020, Turkey also generated 50,790 MW of electricity from renewable sources, corresponding to 53.32 percent of its 97.070 MW installed power as of the end of March 2021. Turkey's total installed capacity of domestic and renewable energy reached 62,125 MW over the same time, accounting for 64% of total installed capacity. Turkey completed 2020 as the fifth largest renewable energy investor in Europe and the 12th largest globally, owing to its investments in renewable energy. The share of wind energy reached a capacity corresponding to 9.7 percent with 333 power plants (Energiewende, 2020).

The Figure 2 illustrates the percentage of power generated by renewable sources. Renewable energy sources include hydropower, solar, wind, biomass and waste, geothermal, wave, and tidal energy (Energiewende, 2020; Ritchie & Roser, 2020).

Figure 2

The Share of Electricity Production from Renewables



In the world, the installed power in renewable energy increased by 260 gigawatts in 2020, reaching a total of 2,799 gigawatts. According to the "Renewable Capacity 2021 Statistics" report of the International Renewable Energy Agency (IRENA), the increase in renewable energy capacity worldwide in 2020 was 50 percent more than in 2019. About 91 percent of green power came from wind and solar investments. During this period, 127 gigawatts of solar energy and 111 gigawatts of wind power were put into use. According to IRENA data, by 2050, renewable energy sources will meet 86% of global energy needs. This is an extremely ambitious but necessary goal for the future of the Earth (IRENA, 2021).

Considering that solar energy is the dominant source of energy on our planet, investment in this type of energy would not be surprising. The use of solar energy is expected to increase significantly in the coming years. When it comes to the distribution of solar grid-connected systems around the globe, China is the leader with its installed power exceeding 78 GW. The People's Republic of China is followed by the United States of America, Japan, and Germany. Turkey is ranked 15th in the current statistics (Güneş, 2018).

When the whole production chain is analyzed in terms of nuclear energy, which is one of the indicators used in this study, nuclear energy is the least polluting option for greenhouse gas emissions. Nuclear energy has a great role in reducing the greenhouse gas concentration in the atmosphere, which causes climate change. Today, nuclear power plants save about 17% annually in greenhouse gas emissions from the electricity sector. In other words, if fossil fuel plants were used to generate power instead of these plants, 1.2 billion tons of carbon would be emitted into the environment each year. On a global scale, 54 nuclear reactors are currently under construction. Eleven are in China, seven are in India, and four are in Russia. Additionally, the construction of 4 nuclear reactors in the United Arab Emirates, 4 in South Korea, 2 in the USA and 1 in France continues (NEUPGM, 2021; TENMAK, 2021).

In this study, MCDM methods were used to determine the evaluation and ranking of 36 countries in the global framework for renewable energy consumption and production, as well as fossil fuel consumption, for the pre- and post-pandemic (2019 and 2020) periods, and recommendations were made based on the results. As a result, the suggested entropy-based PROMETHEE technique examines the consumption and local potential of renewable energy and consumption of fossil fuels in 36 nations from all parts of the globe.

The rest of the research is organized as follows: Section 2 presents a literature review for renewable energy and decision problems. Section 3 explains all the steps of the proposed MCDM methods. Section 4 summarizes the results. Section 5 covers the discussions and Section 6 presents the conclusion.

Literature Review

The literature review on some similar studies on energy and Covid-19 that have been conducted in recent years:

Lee and Chang (2018) used four MCDM approaches (WSM, VIKOR, TOPSIS, and ELECTRE) to conduct a comparative study of renewable energy sources (RES) for power production in Taiwan. The Shannon entropy weight approach was used to determine the relative relevance of each criteria in terms of RES ranking. established a useful guideline for renewable energy planning and decision-making to assist developing nations in more successfully harnessing their plentiful renewable energy resources. They examined Iran as a case study. Ergen and NAZLIGÜL (2021) criticized Turkey and the global energy situation in 2021. Turkey and the condition of the world's energy resources were discussed in detail in this article. Countries' energy reserves, generation, and usage were highlighted. Naderipour et al. (2020) tried to demonstrate the potential benefits of COVID-19 on the environment and the growth of renewable energy production in Malaysia. Kaya (2020) examined the influence of the COVID-19 on the sustainable development of OECD nations, and the countries' sustainable development performance using the Multi-Attributive Ideal-Real Comparative Analysis (MAIRCA) technique. Data for the second quarter of 2020 and the same quarter of the previous year is

considered. The findings of the MAIRCA approach were then compared to those of two distinct multi-criteria decision-making (MCDM) methods, MABAC (Multi-Attributive Border Approximation Area Comparison) and WASPAS. Hoang et al. (2021) discussed the effects of the COVID-19 pandemic on the global energy system and the development toward renewable energy. Additionally, they attempted to provide some recommendations on potential possibilities, problems, and policy implications. aimed to express concepts that would encourage policymakers and stakeholders in energy and electricity production and usage to continue environmental improvements established during the COVID-19 pandemic lockdown. This, they argued, may be accomplished by increasing investment in environmentally friendly technology and reinvigorating renewable energy policy initiatives. At COVID-19, Hosseini (2020), provided a perspective on the worldwide development of renewable and sustainable energy. According to him, effective policies may transform COVID-19's threats into tremendous possibilities for renewables, and the world's sustainable energy picture might eventually turn to its long-term trend of green energy output and usage over the next several years. Wang et al. (2021) used a hybrid methodology that combines the data envelopment analysis (DEA) Window model and the fuzzy technique for order of preference by similarity to ideal solution (FTOPSIS) to assess the renewable energy production capabilities of 42 countries. The study's objective was to provide a technique for nations to assess their renewable energy production potential in order to construct stimulus packages for a cleaner energy future, therefore expediting sustainable development.

Several studies have been undertaken using the approach employed in this study, including the following: Behzadian et al. (2010) conducted an extensive study of the literature on PROMETHEE techniques and applications. 195 articles (89.9 percent) of the 217 publications assessed were deemed appropriate for the objectives of this evaluation. The applications of PROMETHEE methodologies were many and diverse, which made it difficult for the writers to identify pertinent issues. Following a thorough examination of the applications to ascertain similarities and differences, 195 papers were classified into nine categories. The following table summarizes the number of papers and their proportion of the total that deal with each field. As seen in the Table 3, a significant portion of the PROMETHEE papers dealt with environmental management (Behzadian et al., 2010).

Table 3

Distribution of Articles according to Application Areas

Application areas	N	%
Environment Management	47	24.1
Business and Financial Management	25	12.8
Hydrology and Water Management	28	14.4
Chemistry	24	12.3
Logistics and Transportation	19	9.7
Energy Management	17	8.7
Manufacturing and Assembly	19	9.7
Social	7	3.6
Other Topics	9	4.6
Total	195	100

Land-use planning, waste management, Life Cycle Assessment (LCA), and Environmental Impact Assessment (EIA) are just a few of the many dimensions of Environmental Management that have been studied. For the issue of Energy Management, a number of PROMETHEE applications are recommended. Most studies in this field have focused on analyzing and choosing energy generating or exploitation options.

The PROMETHEE method's findings may be represented graphically using the GAIA plane, another descriptive tool. Additionally, this tool is a helpful resource for analyzing conflicts between criteria and resolving the issue of the weights associated with them (Mareschal & Brans, 1988). The GAIA plane is the outcome of Principal Component Analysis (PCA), which preserves the maximum amount of information possible after projection (Brans & Mareschal, 2005). The GAIA plane concept is based on the reduction of multidimensional issues to two dimensions, hence enabling direct presentation. The PCA is an extremely useful tool for the decision-maker since it allows them to distinguish between criteria expressing similar or opposing preferences, as well as the quality of each choice based on the various criteria (Behzadian et al., 2010).

After reviewing the literature on the PROMETHEE approach, it was agreed that the analyzing method for the study would be PROMETHEE and GAIA. Countries might be compared in terms of sustainable environment and energy management, as well as renewable energy consumption. Several comparable studies conducted in recent years are as follows:

Tsiaras and Andreopoulou (2020) used a multiple-criteria analysis of forestry sector data gathered by Eurostat to assess the performance of European nations' forest policies. According to that research, Multiple Criteria Decision Analysis is inextricably linked to policy and decision-making, and it may help decrease planning uncertainty by proposing concrete answers. It is also often used to address environmental challenges. The PROMETHEE technique was used to rank European nations on the basis of their forest policy performance. Digkoglou and Papathanasiou (2018) employed PROMETHEE to evaluate the EU nations according to their environmental performance. Guler et al. (2021)used PROMETHEE to assess the sustainability of energy in 36 OECD (Organization for Economic Cooperation and Development) nations. Phillis et al. (2021) developed a paradigm for defining and quantifying the sustainability of national energy systems in their article. The approach used the PROMETHEE approach to assess sustainability performance of 43 EU nations. R. Remeikienė et al. (2021) suggested a research technique for studying the usage of renewable energy sources, energy efficiency, and environmental factors of energy. The research ranked the EU member states through using PROMETHEE II and entropy techniques.

Methods and Data

This section describes indicator definitions and the methods used. Table 4 presents the energy and environment indicators that were utilized in the research (Economy, 2021). TheGlobalEconomy.com database was used for the values of the indicators. TheGlobalEconomy.com provides reliable data about countries on many issues such as economy, energy and environment. It provides up-to-date data for GDP, inflation, credit, interest rates, renewable energy, agriculture, infrastructure, industry, employment and many other indicators. The data series are constantly updated according to the publication dates of individual countries. They also present over 300 indicators carefully selected from many official sources such as the World Bank, International Monetary Fund, United Nations, and the World Economic Forum (Economy, 2021). Therefore, it was decided to make use of this database.

Table 4

Energy and Environment Indicators

Energy and Environmental Indicators	Definitions
Gasoline consumption, thousand barrels per day	Gasoline consumption includes the consumption of: conventional gasoline; all types of oxygenated gasoline, including gasohol; and reformulated gasoline; but excludes the consumption of aviation gasoline. Volumetric data on blending components, such as oxygenates, are not counted in the data on finished motor gasoline until the blending components are blended into the gasoline.

Table 4

Energy and Environment Indicators (Continued)

Energy and Environmental Indicators	Definitions
Fossil fuels electricity generation, billion kilowatt-hours	Billion kilowatt-hours of electricity generated from fossil fuels including oil, coal, and natural gas.
Coal consumption, thousand short tons	Coal consumption includes anthracite, sub anthracite, bituminous, subbituminous, lignite, brown coal, and oil shale. It also includes net imports of metallurgical coke.
Coal imports, thousand short tons	Amount of foreign coal shipped to the country.
Wind electricity generation, billion kilowatt-hours	Billion kilowatt-hours of electricity generated from wind.
Solar electricity generation, billion kilowatt-hours	Billion kilowatt-hours of electricity generated from sunlight.
Hydroelectricity generation, billion kilowatt-hours	Hydroelectric generation excludes generation from hydroelectric pumped storage.
Nuclear power generation, billion kilowatt-hours	Nuclear electricity net generation (Net generation excludes the energy consumed by the generating units).
Geothermal electricity generation, billion kilowatt-hours	Billion kilowatt-hours of geothermal electricity generated.
Renewable power generation, billion kilowatt-hours	Total Renewables Electricity Net Generation (Net generation excludes the energy consumed by the generating units and also excludes generation from hydroelectric pumped storage)

Entropy Method and Objective Weights

It is essential to create a decision matrix in order to utilize the numerical values of Entropy indicators (Kahraman et al., 2017). Entropy, a notion introduced by Shannon and Weaver (1949) is used to estimate the relative comparison intensities of the decision-making variables (Zeleny, 2012). In spectrum analysis (Burg, 1974), language modeling (Rosenfeld, 1994), and economics (Golan et al., 1997), his technique has been used. The Entropy approach's weight calculation phases are as described in the following: (Apan et al., 2015; Lihong et al., 2008; Shemshadi et al., 2011; Wang & Lee, 2009):

1st Step: The Decision Matrix

$$\boldsymbol{X} = \begin{bmatrix} \boldsymbol{x_{11}} & \cdots & \boldsymbol{x_{1n}} \\ \vdots & \ddots & \vdots \\ \boldsymbol{x_{m1}} & \cdots & \boldsymbol{x_{mn}} \end{bmatrix} \quad (1)$$

2nd Step: A normalized decision matrix is constructed.

These indicators have been standardized based on their benefit or cost characteristics, allowing the values of variables with various units to be compared:

$$r_{ij} = x_{ij}/max_{ij}(i = 1, \dots, m; j = 1, \dots, n)$$
$$r_{ij} = x_{ij}/min_{ij}(i = 1, \dots, m; j = 1, \dots, n) \quad (2)$$

$i\ represents\ alternatives; j =$ criteria; $r_{ij} =$ normalized values;

$x_{ij} =$ benefit values of the $i.$ alternative for j.

$$P_{ij} = \frac{a_{ij}}{\sum_{i=1}^{m} a_{ij}};\ \forall_j \quad (3)$$

Pij represents normalized values, whereas a represents utility values.

3rd Step: Calculating the Entropy value

$$E_j = -k \sum_{i=1}^{m} [P_{ij} \ln P_{ij}]\,; \forall_j \quad (4)$$

$k = entropy\ coefficient\ \{(\ln(n))^{-1}\}$**;**

$P_{ij} = normalized\ values$**;** $E_j = entropy\ value$

4th Step: Computing the (dj) uncertainty value

$$d_j = 1 - E_j;\ \forall_j \quad (5)$$

5th Step: wj weights are calculated to reflect the relative importance of j.

$$w_j = \frac{d_j}{\sum_{j=1}^{n} d_j};\ \forall_j \quad (6)$$

It is calculated that the sum of these weights is 1.

$$w_1 + w_2 + w_j + \cdots + w_n = 1 \quad (7)$$

PROMETHEE (Preference Ranking Organization Method for Enrichment Evaluation)

The PROMETHEE method is a multi-criteria decision making (MCDM) method that enables the analysis of the alternatives to be evaluated by using the preference functions selected according to the determined criteria. This evaluation for alternatives is obtained by making pairwise comparisons (Tolga, 2013). The PROMETHEE I method proposed by Mareschal et al. (1984) performs partial ranking, while the PROMETHEE II method performs full ranking. In addition, later Mareschal and Brans (1988) proposed the GAIA method in 1988, which supports the PROMETHEE method and provides graphical representations. The PROMETHEE method consists of 7 steps (Brans & Vincke, 1985; Dağdeviren & Erarslan, 2008; Ishizaka & Nemery, 2011):

Step 1: Decision matrix consisting of elements $w=(w_1, w_2, \ldots, w_k)$ representing the weights and A=(a, b, c,…) describing the alternatives evaluated by $c=(f_1, f_2, \ldots, f_k)$ representing k criteria .

Step 2: Normalize the decision matrix as follows:

$$R_{ij} = \frac{\left[X_{ij} - \min\left(X_{ij}\right)\right]}{\left[\max\left(X_{ij}\right) - \min\left(X_{ij}\right)\right]}$$
$$(i = 1, 2, \ldots, n \text{ and } j = 1, 2, \ldots, m) \quad (8)$$

where Xij represents the decision maker's assessment of the ith choice in relation to the j^{th} criteria.

Step 3: $P_j(i,i')$, the preference function, should be chosen and calculated. The PROMETHEE approach generates a preference function that describes the decision maker's preference difference for each criteria between pairs of options. There are six various forms of generalized preference functions, and each criteria may have its own function (Canedo & de Almeida, 2008). Figure 3 illustrates these preference functions (Brans & Mareschal, 2005; Brans & Vincke, 1985; Yaralıoğlu, 2010).

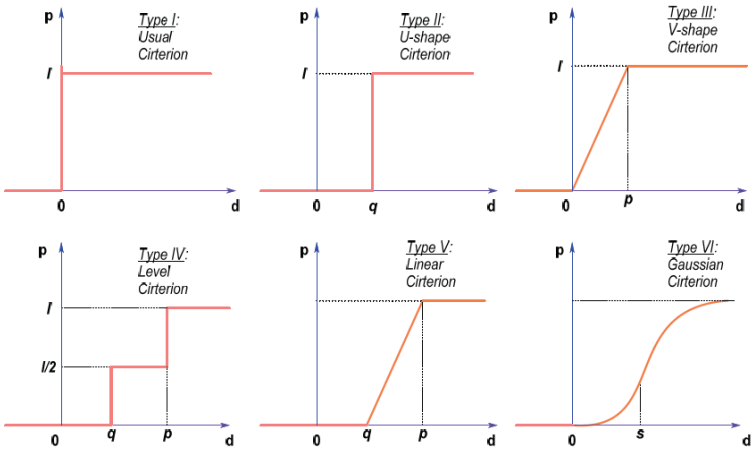
a) If there is no preference among the criteria for the decision makers, it is appropriate to choose the First Type (usual) preference function for the relevant criteria.

b) If the decision maker evaluates some criteria and wants to choose alternatives with a value above a value he deems appropriate, he should choose the Second Type (U type) preference function.

c) When the decision maker evaluates the alternatives according to some criteria, if he wants to prefer the alternatives with a value above the average value in these criteria, but does not want to ignore the alternatives with a value lower than this average value, it is appropriate to choose the Third Type (V type) preference function for these criteria.

Figure 3

Preference Functions in PROMETHEE



d) While the decision maker is evaluating the alternatives, if he/she wants to prefer value areas within a value range that he/she deems appropriate according to the criteria he/she has determined, he/she should choose the Fourth Type (level) preference function.

e) When the decision maker evaluates the alternatives according to some criteria and wants to prefer the alternatives with a value above the mean value in these criteria, it is appropriate to determine the Fifth Type (linear) preference function.

f) If the deviation values of the relevant criteria from the mean are important for the decision maker while deciding about the alternatives, the Sixth Type (Gaussian) preference function should be selected.

Step 4: Calculate the weighted aggregated preference function:

$$\pi(i,i') = \sum_{j=1}^{m} P_j(i,i') w_j \tag{9}$$

Where w_j denotes the j^{th} criterion's relative importance.

Step 5: Each alternative can be related to (n−1) alternatives, resulting in a positive or negative outranking flow. Thereafter, it is necessary to calculate the leaving and entering outranking flows, which are given by the following equations:

The leaving flow:

$$\phi^{+}(i) = \frac{1}{n-1} \sum_{i'=1}^{n} \pi(i,i'), \quad (i \neq i') \tag{10}$$

The entering flow:

$$\phi^{-}(i) = \frac{1}{n-1} \sum_{i'=1}^{n} \pi(i',i), \quad (i \neq i') \tag{11}$$

where n is the number of alternatives. The entering flow is a measure of the weakness of the alternatives, while the leaving flow is a measure of the strength of the alternatives.

Step 6: PROMETHEE II generates a complete preorder determined by the net outranking flow of the decision alternatives. The net outranking flow is:

$$\phi(i) = \phi^{+}(i) - \phi^{-}(i) \quad (12)$$

Step 7: Accepting or rejecting incomparability is necessary for the resolution of a given choice issue. If decision maker accepts it, he uses the PROMETHEE I, otherwise, he uses the PROMETHEE II. PROMETHEE I generally lead to a ranking of the actions by a partial pre-order since it accepts the incomparability. PROMETHEE II leads to a ranking of alternatives by a total pre-order as it does not accept the incomparability: all the alternatives are ranked from the best to the worst one.

In fact, φi can be positive or negative. The larger φi, the more xi outranks the other alternatives, the less it is outranked. Thus:

- x_i outranks x_j if and only if $\phi_i > \phi_j$
- x_i is indifferent to x_j if and only if $\phi_i = \phi_j$.

Φ+ (a) > Φ+ (b) and Φ-(a) < Φ-(b)

Decide the entire rank order of the choices (PROMETHEE II) considering the net outranking flow, φ(i). The highest φ(i) is the most acceptable option.

Results

The decision matrix used in the entropy analysis and consisting of raw values of the indicators is presented in Appendix A.

Table 5 shows the weights of the energy indicators obtained by the Entropy method. The decision matrix for the PROMETHEE study was the transformed normalized decision matrix described in Appendix B. Indicator values were normalized and converted to values in the range of 0-1. The transformation was performed with the procedure specified in the second step of the PROMETHEE methodology.

Table 5

Entropy Weights of the Energy Indicators

Indicators	Definitions	Weights
C1	Gasoline consumption, thousand barrels per day	0.1412
C2	Fossil fuels electricity generation, billion kilowatthours	0.1225
C3	Coal consumption, thousand short tons	0.118
C4	Coal imports, thousand short tons	0.1052
C5	Wind electricity generation, billion kilowatthours	0.0847
C6	Solar electricity generation, billion kilowatthours	0.0815
C7	Hydroelectricity generation, billion kilowatthours	0.0623
C8	Nuclear power generation, billion kilowatthours	0.097
C9	Geothermal electricity generation, billion kilowatthours	0.0847
C10	Renewable power generation, billion kilowatthours	0.1029

The values in the first four indicators are inverted according to the multiplication process, as is frequently used in the literature, so that the indicators that are desired to be minimum can be processed when they are specified as maximum. The study was conducted using Visual PROMETHEE, a user-friendly tool. The software is a significant multi-criteria decision support system that was developed for the purpose of implementing the PROMETHEE approach.

The research investigated both the 2019 and 2020 data for the nations in order to draw a comparison between the pre- and post-pandemic periods. Thus, it is aimed to analyze whether the values of the countries within one year affect their ranking in terms of energy criteria and to analyze their performance in both periods. As a result, the data of the countries for these two years are included in the decision matrix.

The weights used in the analysis were obtained from the Entropy analysis. In the PROMETHEE method, there are various preference functions that specify the structure and interrelationship of the evaluation criteria. These are explained in detail in the methodology section. If there is no priority for each of the criteria determining the preference for the decision makers, the first type, that is, the usual preference function, is preferred. Therefore, the preference function was determined as the first type (usual) function for all criteria, in order to make the evaluation by using only the determined Entropy weights without prioritizing certain value ranges for any criterion, regardless of subjective evaluations. Since the usual type preference function was preferred in the analysis, the values of the parameters q (indifference value), p (exact preference threshold) and s (intermediate value between p and q or standard deviation) were left blank. The parameters used in the PROMETHEE analysis are listed in Table 6.

Table 6

The Parameters of PROMETHEE Analysis for 2019-2020

	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**	**C10**
Direction of preference	max	max	max	max	max	max	max	max	max	max
Weight coefficient	0.1412	0.1225	0.118	0.1052	0.0847	0.0815	0.0623	0.097	0.0847	0.1029
Preference function	Usual	Usual	Usual	Usual	Usual	Usual	Usual	Usual	Usual	Usual

The analysis's outputs and their interpretations are described later in this section. Each action is represented in the PROMETHEE Diamond by a point in the (Phi+, Phi-) plane. So that the vertical dimension (green-red axis) corresponds to Phi net flow, the plane is inclined 45 degrees. From the left to the top corner, Phi+ scores rise, whereas Phi- scores rise from the bottom to the top corner.

Each action is represented by a cone. In the PROMETHEE I Partial Ranking, overlapping cones indicate that one action is chosen over the other. Cones that intersect represent activities that cannot be compared. Using the vertical dimension, which corresponds to Phi, it is possible to see both the PROMETHEE ranks at once. Sweden'20 is definitely favored to all other activities, whereas South Korea'20 and the Netherlands'19 are incomparable, according to the findings.

PROMETHEE I provides a partial rating of nations based on energy parameters. There are three potential outcomes in terms of nations compared in this study, which includes pairwise comparisons of countries with computed positive and negative superiority values. In summation, these conceivable outcomes include a country's dominance over another, a country's indifference to another, and a country's incomparability to another. The PROMETHEE I method's partial ranking is shown in Figure 5 as the PROMETHEE Network. Each action is represented by a node in the PROMETHEE Network display, while preferences are indicated by arrows. The nodes are positioned relative to the PROMETHEE Diamond, highlighting the proximity of flow values.

In the PROMETHEE Network, Sweden’20 is clearly preferred to all the other countries, while South Korea’20 and Netherlands’19 are incomparable but very close to each other. Sweden is followed in dominance over other nations by Switzerland and Norway. For nations where the comparison findings are unclear, the PROMETHEE II approach must be used to acquire the whole ranking.

Figure 4

PROMETHEE Diamond

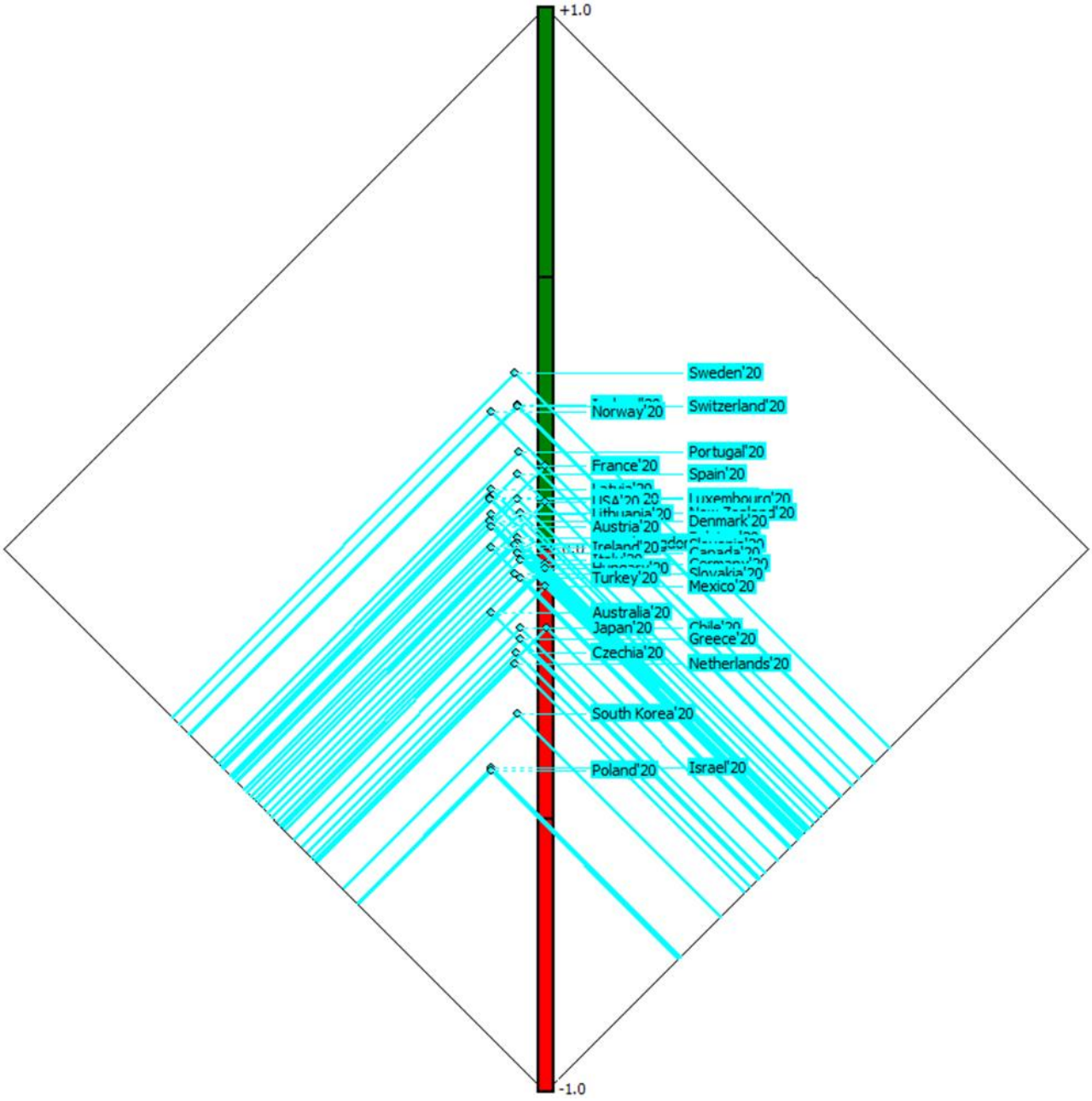
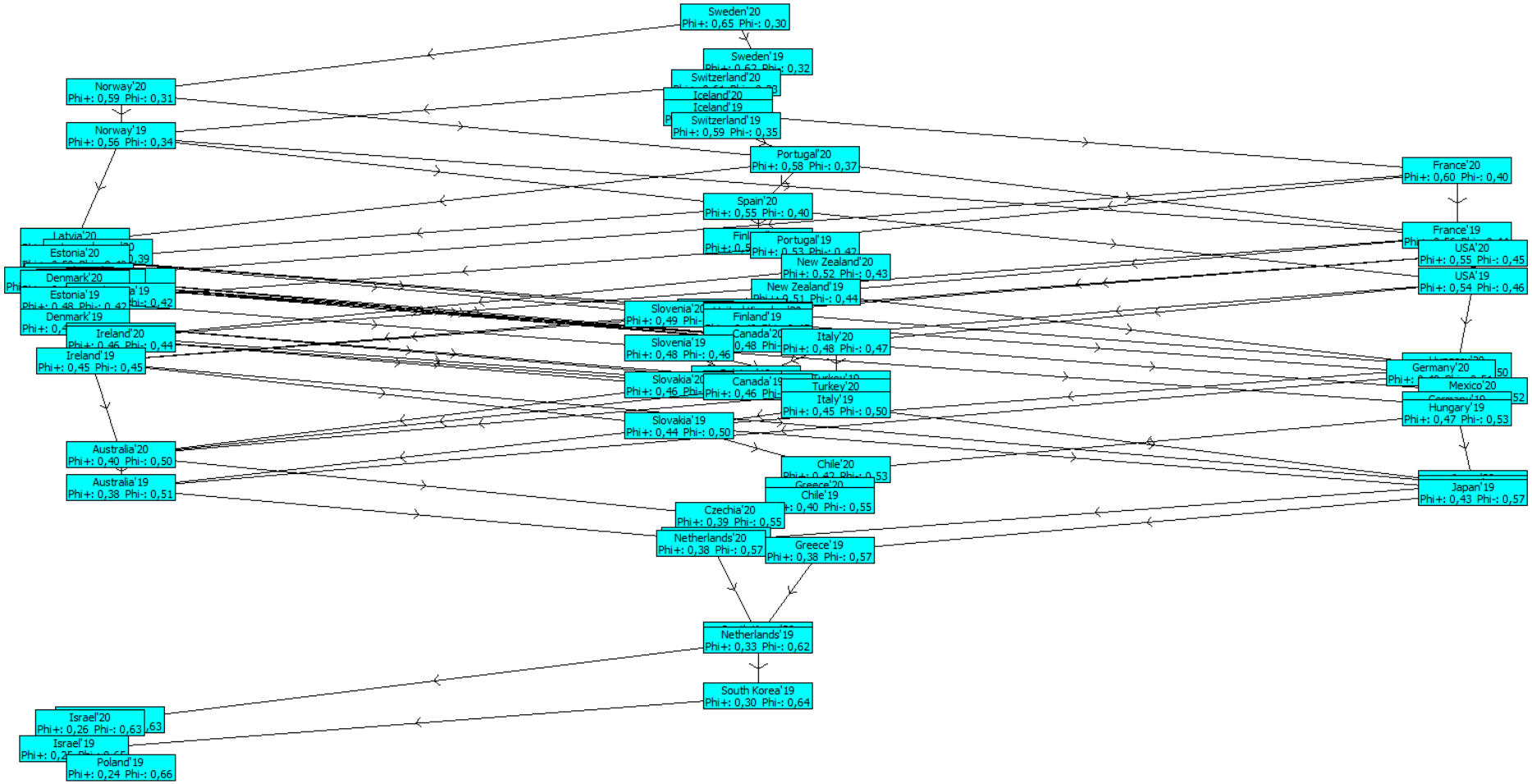


Figure 5

PROMETHEE Network



PROMETHEE II results provide a comprehensive ranking of nations, taking into consideration the net advantage value determined using negative and positive superiority values. It reaches the full rank value (Phi) by subtracting the negative superiority (Phi-) value from the positive superiority (Phi+) value. The PROMETHEE II results seen in Table 8 show the positive advantage value, negative advantage value, net advantage value and ranking of countries. Sweden, according to this research, ranks top among other nations in terms of net Phi values for both the 2019 and 2020 energy criterion. Sweden, Switzerland, Norway, Iceland, Portugal, and France are the top five nations in the list. The countries at the bottom of the ranking are Czechia, Netherlands, Greece, South Korea, Poland and Israel.

Table 7

Positive, Negative, Net Advantage Values Obtained by PROMETHEE II Analysis and Full Ranking

Rank	Action	Phi	Phi+	Phi-	Rank	Action	Phi	Phi+	Phi-
1	Sweden'20	0,3479	0,6462	0,2983	**37**	Ireland'20	0,0200	0,4593	0,4392
2	Sweden'19	0,3020	0,6241	0,3222	**38**	Italy'20	0,0166	0,4844	0,4678
3	Switzerland'20	0,2809	0,6124	0,3315	**39**	Slovenia'19	0,0114	0,4759	0,4645
4	Norway'20	0,2720	0,5853	0,3132	**40**	Ireland'19	-0,0022	0,4470	0,4492
5	Iceland'20	0,2629	0,6031	0,3402	41	Hungary'20	-0,0068	0,4960	0,5028
6	Iceland'19	0,2505	0,5969	0,3464	42	Germany'20	-0,0142	0,4917	0,5059
7	Switzerland'19	0,2368	0,5904	0,3536	43	Belgium'19	-0,0203	0,4626	0,4829
8	Norway'19	0,2274	0,5629	0,3356	44	United Kingdom'19	-0,0258	0,4603	0,4860
9	Portugal'20	0,2030	0,5764	0,3734	45	Turkey'19	-0,0260	0,4631	0,4891
10	France'20	0,1916	0,5952	0,4036	46	Slovakia'20	-0,0269	0,4567	0,4836
11	Spain'20	0,1547	0,5505	0,3958	47	Canada'19	-0,0285	0,4589	0,4874
12	France'19	0,1252	0,5620	0,4368	48	Mexico'20	-0,0329	0,4836	0,5164
13	Finland'20	0,1199	0,5331	0,4132	49	Turkey'20	-0,0333	0,4594	0,4928
14	Latvia'20	0,1194	0,5072	0,3878	50	Italy'19	-0,0464	0,4529	0,4993
15	Portugal'19	0,1156	0,5327	0,4171	51	Germany'19	-0,0473	0,4758	0,5230
16	Luxembourg'20	0,1085	0,5026	0,3942	52	Hungary'19	-0,0554	0,4717	0,5271
17	USA'20	0,1078	0,5539	0,4461	53	Slovakia'19	-0,0677	0,4363	0,5040
18	Estonia'20	0,1028	0,4989	0,3961	54	Australia'20	-0,0977	0,4004	0,4981
19	New Zealand'20	0,0930	0,5226	0,4296	55	Chile'20	-0,1128	0,4197	0,5325
20	Luxembourg'19	0,0845	0,4899	0,4054	56	Japan'20	-0,1268	0,4366	0,5634
21	Latvia'19	0,0800	0,4869	0,4069	57	Australia'19	-0,1309	0,3838	0,5147
22	USA'19	0,0791	0,5396	0,4604	58	Mexico'19	-0,1324	0,4338	0,5662
23	Austria'20	0,0790	0,4888	0,4097	59	Greece'20	-0,1343	0,4084	0,5426
24	Lithuania'20	0,0777	0,4869	0,4093	60	Japan'19	-0,1358	0,4321	0,5679
25	Denmark'20	0,0772	0,4861	0,4089	61	Chile'19	-0,1438	0,4036	0,5474
26	New Zealand'19	0,0683	0,5091	0,4408	62	Czechia'20	-0,1599	0,3922	0,5521
27	Lithuania'19	0,0634	0,4809	0,4176	63	Czechia'19	-0,1850	0,3791	0,5640
28	Estonia'19	0,0595	0,4772	0,4177	64	Netherlands'20	-0,1878	0,3775	0,5653
29	Belgium'20	0,0472	0,4958	0,4486	65	Greece'19	-0,1952	0,3779	0,5731
30	Slovenia'20	0,0457	0,4930	0,4473	66	South Korea'20	-0,2812	0,3326	0,6138
31	Spain'19	0,0446	0,4955	0,4508	67	Netherlands'19	-0,2860	0,3301	0,6162
32	United Kingdom'20	0,0434	0,4949	0,4514	68	South Korea'19	-0,3433	0,3015	0,6448
33	Finland'19	0,0375	0,4919	0,4544	69	Poland'20	-0,3674	0,2651	0,6325
34	Denmark'19	0,0371	0,4660	0,4290	70	Israel'20	-0,3700	0,2631	0,6331
35	Austria'19	0,0229	0,4607	0,4378	71	Israel'19	-0,3969	0,2490	0,6460
36	Canada'20	0,0201	0,4832	0,4631	72	Poland'19	-0,4162	0,2412	0,6573

Table 8 summarizes the performance scores derived from the PROMETHEE II study.

Table 8

PROMETHEE II Method Ranking and Scores

Countries	Score	Countries	Score	Countries	Score
Sweden '20	100	Denmark '20	56.47	Turkey '20	45.26
Sweden '19	90.24	New Zealand '19	55.48	Italy '19	44.09
Switzerland '20	86.17	Lithuania '19	54.93	Germany '19	44.01
Norway '20	84.54	Estonia '19	54.5	Hungary '19	43.3
Iceland '20	82.9	Belgium '20	53.17	Slovakia '19	42.24
Iceland '19	80.71	Slovenia '20	53.02	Australia '20	39.77
Switzerland '19	78.4	Spain '19	52.9	Chile '20	38.57
Norway '19	76.86	United Kingdom '20	52.77	Japan '20	37.49
Portugal '20	73.03	Finland '19	52.15	Australia '19	37.18
France '20	71.32	Denmark '19	52.11	Mexico '19	37.06
Spain '20	66.08	Austria '19	50.65	Greece '20	36.93
France '19	62.23	Canada '20	50.37	Japan '19	36.81
Finland '20	61.56	Ireland '20	50.36	Chile '19	36.22
Latvia '20	61.49	Italy '20	50.01	Czechia '20	35.04
Portugal '19	61.02	Slovenia '19	49.5	Czechia '19	33.28
Luxembourg '20	60.15	Ireland '19	48.17	Netherlands '20	33.08
USA '20	60.07	Hungary '20	47.73	Greece '19	32.58
Estonia '20	59.46	Germany '20	47.03	South Korea '20	27.14
New Zealand '20	58.3	Belgium '19	46.45	Netherlands '19	26.86
Luxembourg '19	57.31	United Kingdom '19	45.95	South Korea '19	23.65
Latvia '19	56.79	Turkey '19	45.93	Poland '20	22.38
USA '19	56.69	Slovakia '20	45.84	Israel '20	22.25
Austria '20	56.68	Canada '19	45.7	Israel '19	20.89
Lithuania '20	56.53	Mexico '20	45.3	Poland '19	19.94

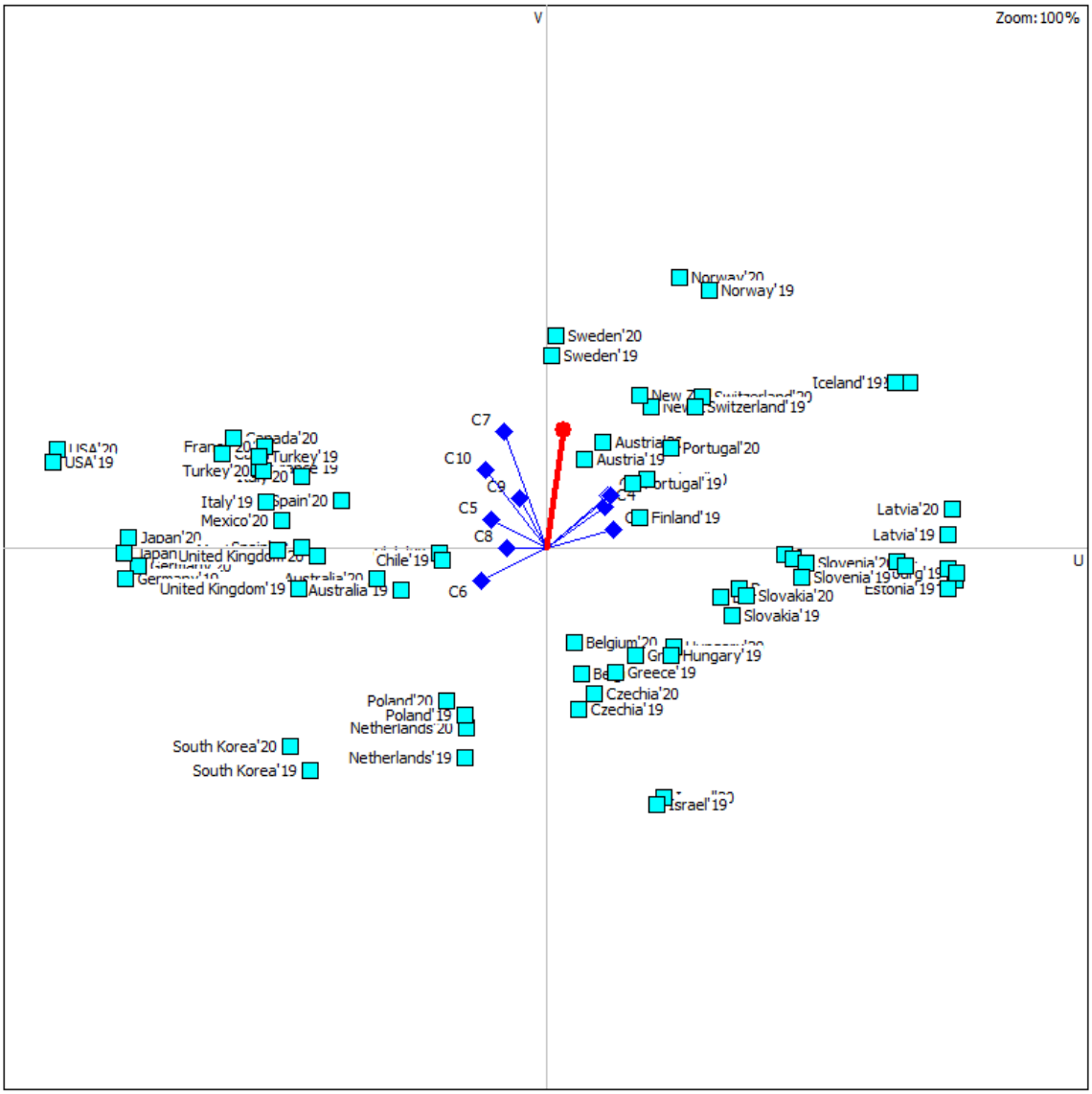
The PROMETHEE II assessment on the GAIA plane is shown in Figure 6. This graph was generated employing PROMETHEE IV. In fact, there are two possible outcomes:

1. When the Brain is completely located inside one side of the GAIA plane, the Decision Axis is constantly positioned in the same direction, implying that the PROMETHEE rankings should be stable. The preferred countries are easy to identify.

2. When the Brain overlaps the GAIA plane's center, it indicates that the Decision Axis is orientable in any direction. Thus, the PROMETHEE ranks might be very different depending on the weight values used within the limits set by the decision maker. As a result, the issue becomes far more difficult to evaluate. The location of nations on the criterion axis illustrates how well their activities perform on the various criteria.

Figure 6

GAIA Graphic



Consider the criteria C6 in Figure 6 (solar electricity generation). The orientation of the corresponding axis is critical: in this example, the C6 axis is orientated to the left. This means that the further to the left of the GAIA plane a nation is, the better it is at meeting criteria C6. According to the C6 criteria axis orientation, the 'best' values are on the left and the 'worst' values are on the right. Each country is projected orthogonally on the criteria direction. The forecasts depict the relative performance of the countries on the selected criteria. Distance from the criteria is significant. What important is the country's projected position on the criteria. In the Figure 6:

· USA '20 is clearly the best country (in terms of C6 solar electricity generation criterion), USA '19 value is closest to this value.

· Japan '20 and Japan '19 are the second best (in terms of solar electricity generation) and have very similar values,

· Finland'19 is worse than USA and Japan in terms of C6 criteria,

· Iceland'19 and Iceland'20 have the worst value for C6 solar electricity generation criterion

Naturally, this information is limited by the quality of the GAIA plane. The Decision Axis is a visual representation of the weighing of the criteria in the GAIA plane. As weights are allocated to the criteria the best countries in the PROMETHEE rankings are more or less influenced by the different criteria. The Decision Axis is similar to a weighted average of the criteria axes. It indicates the direction of the PROMETHEE II ranking and thus show which criteria are in agreement with the PROMETHEE II ranking and which are not. This can be beneficial for identifying factors that are under- or over-weighted.

In the Figure 2 one can see that with the current weights of the criteria, PROMETHEE will probably propose countries that are good on C1 (Gasoline consumption, thousand barrels per day), C2 (Fossil fuels electricity generation, billion kilowatt hours), C3 (Coal consumption, thousand short tons), C4 (Coal imports, thousand short tons), C7 (Hydroelectricity generation, billion kilowatt hours) and C10 (Renewable power generation, billion kilowatt hours). When the weights of the criteria are modified, the position of the Decision Axis changes.

When studying the GAIA plane, it is critical to consider the length of the Decision Axis. A short Decision Axis indicates that it is angled away from the GAIA plane and hence poorly represented. The Decision Axis's direction becomes much less useful in this case. Actually, the Decision Axis is the projection of the weight vector (Decision Stick) on the GAIA plane. In the Visual PROMETHEE, the U-V plane has a very high-quality level close to 90% (actually 83.4%). Thus, the third axis contributes just a marginal gain in quality. The 3D representation quality level is equal to 91%. When evaluating the U-W (quality level: 70%) or W-V (quality level: 21%), it should be remembered that the third axis accounts for 8% of the overall quality level. Therefore, the U is by far the most informative axis. Consequently, the significant distinctions between these 36 nations may be described using a single axis.

On the GAIA plane, alternatives (countries) are represented as points, while criteria are represented as vectors. For example, Sweden, Norway, Switzerland and Iceland among the countries tried to be ranked are in the direction of the best compromise solution because they are in the direction indicated by the decision stick. Netherlands, South Korea, Poland and Israel, which are in the opposite direction of these countries, are the countries in the worst position in terms of the criteria included in the analysis. On the GAIA plane, it can be said that the countries clustered together close to each other have similar profiles with each other in terms of energy criteria. Similarly, it can be said that the differences in the values of the energy criteria of the countries that are far from each other on the plane are large. Showing the single criterion net flows of the countries together reveals the profiles of the countries. In order to show that the two countries located close to each other on the GAIA plane are similar to each other, Sweden, Switzerland and Norway, which are at the top of the ranking and close to each other on the plane, and Turkey, which are located in opposite directions, are selected as an example and in Figure 7, profile graphics are presented in terms of criteria. It can be noticed that the countries that are close to each other have very similar profile graphs in terms of their advantageous and disadvantageous indicators.

Visual PROMETHEE software is used to generate some helpful graphical representations. Among these is the Rainbow diagram (see Figure 8 and Figure 9). This graphic is beneficial since it summarizes the advantages and disadvantages of each alternative (in this case, countries). The advantages are shown above the histograms, while the disadvantages are displayed below. As seen in Figure 8 and Figure 9, the top five ranked nations have a greater number of advantages than disadvantages, which contributes to their favorable position in the final ranking.

Figure 7

Action Profile of Countries

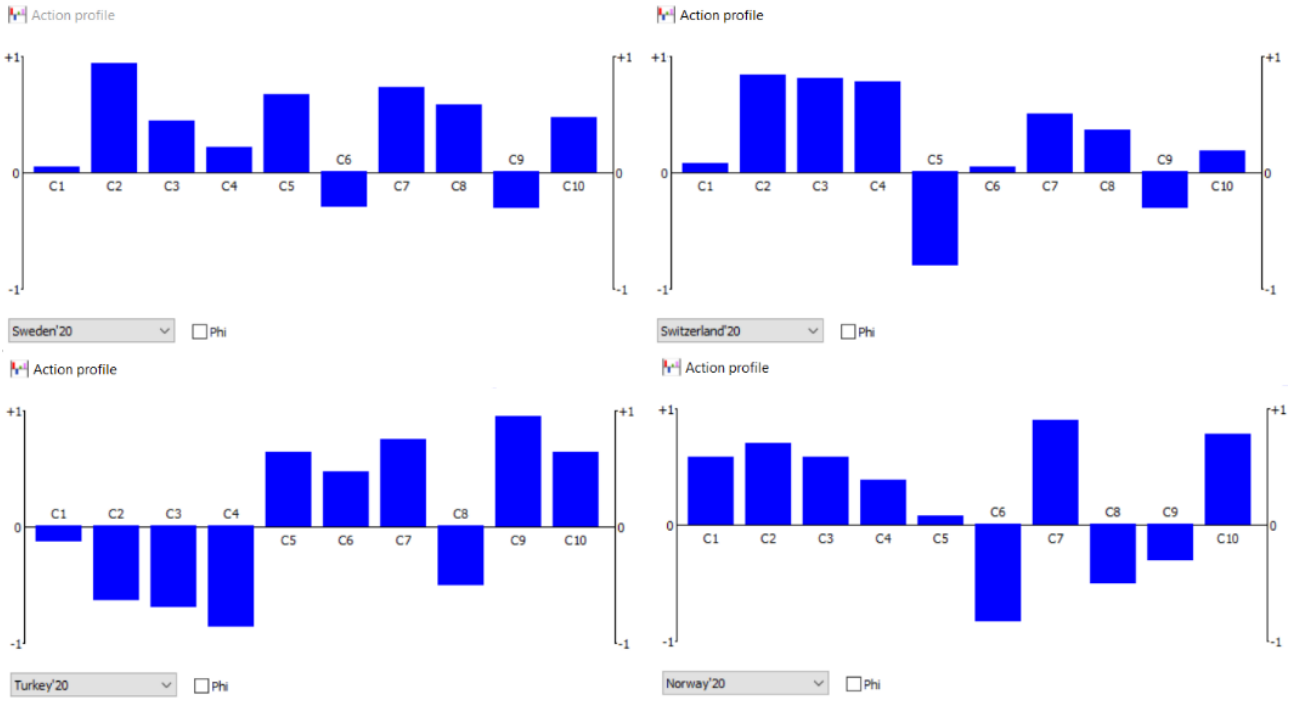


Figure 8

Rainbow Diagram for 2019

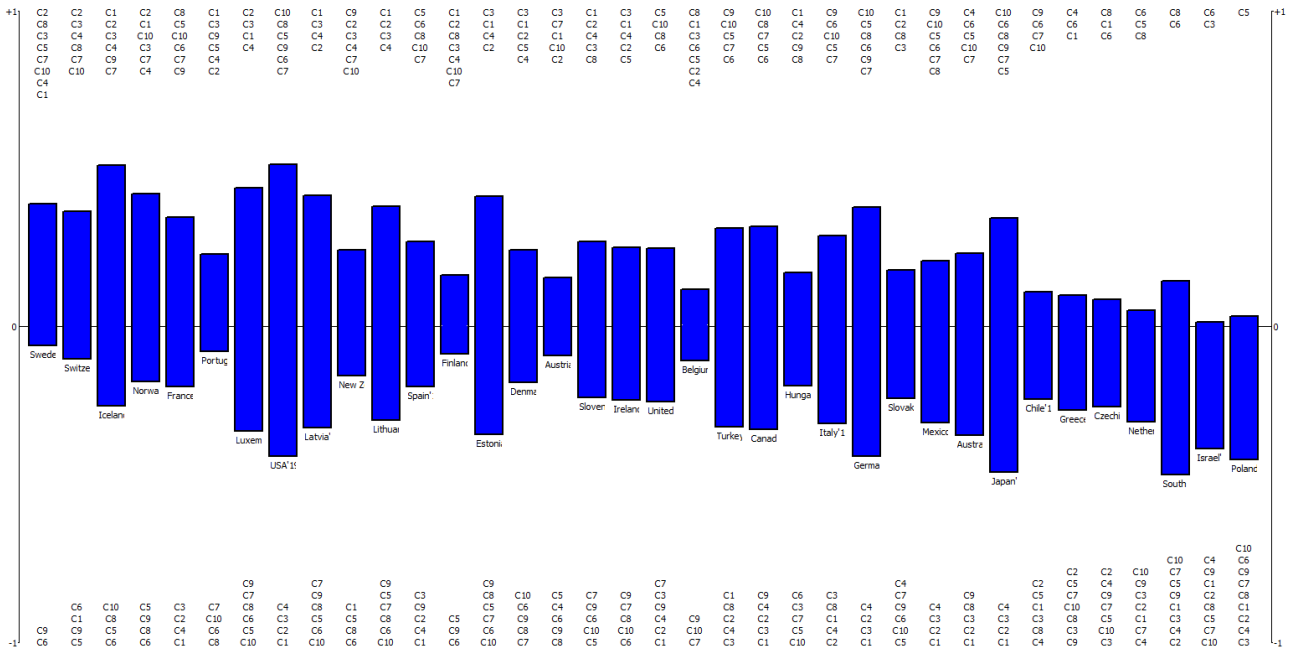
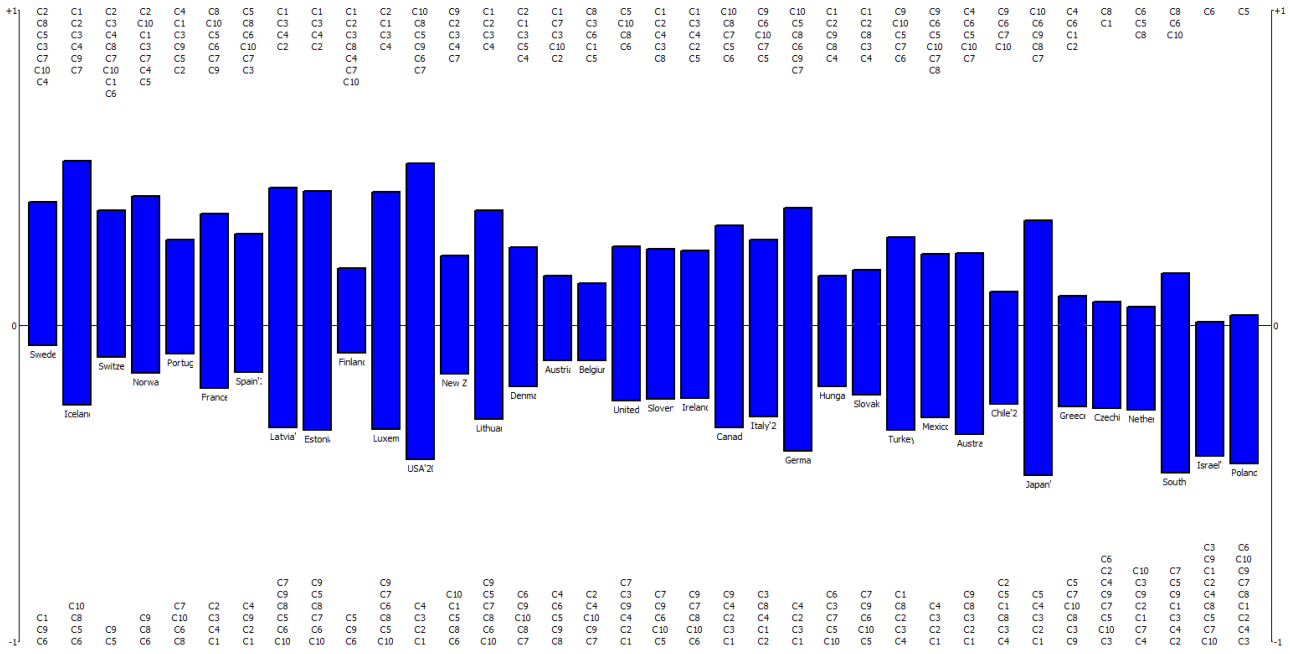


Figure 8

Rainbow Diagram for 2019 (Continued)



Discussion

The most important limitation of this study is the lack of a comprehensive database that would allow the evaluation of all countries or the majority of them together. In addition, the difficulties experienced in obtaining up-to-date data from countries and the lack of data from large economies such as China, India and Russia in databases such as the World Bank limit the scope of the study. In order to solve this problem, it is important to determine common indicators and to collect and publish data periodically over a common database. The novelty of the study is that it provides important data about the current literature on energy and that 36 countries with significant economic power from almost all continents are evaluated in terms of energy consumption and preferences with both pre-pandemic 2019 and 2020 pandemic data.

Since MCDM methods such as the Analytic Network Process (ANP) and Analytic Hierarchy Process (AHP) are based on subjective evaluations, very different results can be obtained in different analyses for the same indicators. When the criterion weights are determined by subjective evaluations, the results obtained by the same methods for the same indicators will be different. In this study, the MCDM methods were used, with the criteria being objectively weighted and not requiring any subjective evaluation, and only processing and evaluating the criteria values. In other words, the evaluations were carried out in a completely objective framework. Due to the computational differences of other MCDM methods, there may be some differences in the rankings obtained in future studies. When the results from the study are evaluated in general, the results are consistent with the rankings of other studies in the literature.

In this study, it is emphasized how the objective weights should be and which indicators come to the fore in the comparison of these countries by analyzing the energy indicators, taking into account the values of the countries being compared. The strengths and weaknesses and relative comparisons of these countries in their current situation are presented. The dimension with the largest weight, according to the study's Entropy analysis, is "C1 Gasoline consumption, thousand barrels per day". In addition, the study focuses on the renewable and fossil fuel consumption levels of countries and the change in consumption habits between periods. The study compares the leading countries from all continents using objective assessment methodologies such as entropy and PROMETHEE and also compares the results obtained from this study with

the studies described in the literature review section. Rather than addressing a specific country or region, as is done in many studies, it is aimed to make an assessment on a global scale as much as possible.

The PROMETHEE method is slightly more advantageous than other methods in terms of visually evaluating both the similarities of countries and similar and different country groups in terms of indicator values. In addition, as it is emphasized in the literature review section about the method, the fact that it is a preferred method in energy and environmental management studies is the reason why it was preferred in this study.

The results of this study are similar to the results of the Rita et al. (2021) study, and it is seen that the renewable energy production and consumption tendencies of the countries increased during the pandemic period and increased their capacities in this direction. Of course, this shows that there is a meaningful progress in improving air quality and in the fight against global warming.

Phillis et al. (2021) proposed a framework for defining and measuring the sustainability of national energy systems. The framework had an application of the PROMETHEE method to evaluate the sustainability performance of 43 European countries.

When the results of Phillis et al. (2021) and the rankings of the same countries analyzed in both studies are evaluated together, Sweden, Switzerland, Norway, Iceland, France, Spain and Portugal are at the top of the rankings, while Turkey, Hungary, Greece and Czechia are among the countries with lower rankings and at the bottom of the list. Although there are two studies that deal with different aspects of energy, they produce similar results in terms of leading and underperforming countries. This shows the consistency of the study with the literature.

Conclusion

It is hoped that, in accordance with the Paris Climate Agreement's aims, the rise in air temperature would be limited to 1.5 degrees Celsius until 2050. To accomplish this, the European Union (EU) increased its emission reduction target to 55 percent in 2030. The EU aims to use an average of 32 percent renewable energy by 2030 and to be carbon-neutral by 2050. Additionally, the transition of companies to clean energy on their own initiative can make a significant contribution to reducing carbon emissions, which is encouraged by several regulations. Contribution of renewables in the energy mix of a country is now more important than ever. A higher share of renewable energy sources implies less pollution, fewer CO2 emissions, and a decreased contribution to climate change.

The Covid-19 crisis and the measures taken to slow its spread have had a profound impact on energy demand not seen in 70 years. This unique situation, along with government incentive packages, will significantly change the energy industry in the future years. Additionally, it will have a significant impact on the energy sector, energy security, and clean energy transitions in general.

When the literature was reviewed, it was determined that there is a need for new studies on the evaluation of energy use preferences and policies of countries and the energy situation of the countries before and during the pandemic. In order to fill this gap, an energy evaluation was aimed in a very broad framework in terms of content and scope. This study aimed to compare and evaluate 36 countries with data on all indicators by taking advantage of Entropy-based PROMETHEE methods. PROMETHHE methods were also preferred because they are the most preferred MCDM methods in environmental and energy issues, as stated in the literature review.

As a result of entropy calculations, while the criterion with the highest importance is the gasoline consumption criterion with a value of 14.12%, the criterion that follow this criteria in order are the fossil fuels electricity generation (12.25%); coal consumption (11.8%); coal imports (10.52%); renewable power generation (10.29%); nuclear power generation (9.7%); geothermal electricity generation (8.47%); wind electricity generation (8.47%); solar electiricity generation (8.15%); hydroelectricity generation (6.23%).

According to the results of the study, Sweden ranks first among other nations in terms of net Phi values for energy criterion using both 2019 and 2020 data. Sweden, Switzerland, Norway, Iceland, Portugal and France are at the top of the list, whereas Czechia, Netherlands, Greece, South Korea, Poland, Israel are at the bottom. According to the PROMETHEE II score values for 2020 and 2019, all of the countries in the top 10 of the list are EU countries. This situation shows how well the European Union and its member countries' renewable energy transition plans are being implemented. These nations are followed by the United States of America and New Zealand. The last of the list consists of Australia, Chile, Mexico, Japan, Israel, South Korea and some EU countries such as Greece and the Netherlands. As a result, the countries at the end of the PROMETHEE II ranking do not belong to a particular area, as at the beginning of the list.

Alternatives (countries) on the GAIA plane are shown as points and criteria are shown as vectors. For example, Sweden, Norway, Switzerland and Iceland, which are tried to be ranked, are in the direction of the best compromise solution because they are in the direction indicated by the decision stick. Netherlands, South Korea, Poland and Israel, which are in the opposite direction of these countries, are the countries in the worst position in terms of the criteria included in the analysis. On the GAIA plane, it can be said that the countries clustered close to each other have similar profiles with each other in terms of energy criteria.

Sweden, as the first ranked country, is a good performer in all the observed aspects except for the level of C6 (Solar electricity generation, billion kilowatt hours) and C9 (Geothermal electricity generation, billion kilowatt hours). At the very bottom of the rankings, there is Poland, with advantages only regarding the low level of C5 (Wind electricity generation, billion kilowatt hours) indicator.

The study presents an important novelty and contribution to the literature by taking into account the content of the indicators used, the scope of the countries it deals with, the data of the pandemic period and before. Another key aim and contribution of this study is to propose an integrated framework for defining and evaluating national energy sustainability based on Multiple Criteria Decision Making (MCDM) to overcome certain weaknesses of composite indicators related to weighting, summation and robustness. The preferred method is PROMETHEE, an MCDM approach that has an important perspective in measuring sustainability, given that a country's poor performance in a particular sustainability indicator may not be compensated for by good performance in other indicators.

The political and social implications and recommendations to be drawn from this study can be summarized as follows:

Renewables generated 38% of Europe's electricity in 2020 (up from 34.6 percent in 2019), surpassing fossil-fuel production, which decreased to 37%. This is a watershed moment in Europe's shift to a clean energy future. Germany and Spain (and, separately, the United Kingdom) also reached this goal for the first time. However, the shift from coal to renewable energy is still too inadequate to achieve a 55 percent decrease in greenhouse gas emissions by 2030 and climate balance by 2050.

While Covid-19 had an effect in every country, it had a negligible effect on the overall movement away from fossil fuels toward renewables. Renewable energy growth has been encouragingly strong in the face of the pandemic, and the decline in fossil-fired power might have been much greater had it not been for such a strong rebound in electricity demand and the worst year on record for nuclear output. Wind and solar energy are driving Europe's renewable energy growth. Wind generation increased by 9% in 2020, while solar generation increased by 15%. In 2020, they will produce one-fifth of Europe's electricity. Since 2015, wind and solar have catalyzer for all of Europe's renewable energy expansion, whereas bioenergy progress has declined and hydro capacity has remained stable.

Renewable energy development is still too weak – wind and solar power should almost treble to meet Europe's 2030 green agreement targets: from 38 TWh per year on average between 2010 and 2020 to 100 TWh per year on average between 2020 and 2030. It is positive that wind and solar combined rose by 51 terawatt-hours in

2020, far more than the average for the period 2010-2020, despite some damage of pandemic. In 2021, the IEA forecasts an unprecedented increase in wind and solar installations. Furthermore, EU member states' 2030 obligations must be significantly increased.

Coal production decreased 20% in 2020 and has been shortened in half since 2015. Coal generation declined in practically every nation, accelerating the coal industry's decline that began far before Covid-19. Half of the 2020 decline was due to lower power usage, which reduced by 4% as a result of the effect of Covid-19; the other half was due to increased wind and solar energy generation. When power demand recovers in 2022, wind and solar energy will need to expand at a quicker pace if current coal price declines are to be continued. This situation indicates that Europe's energy was 29 per cent cleaner in 2020 than it was in 2015. The CO2 emission of electricity has decreased from 317 grams of CO2 per kilowatt-hour in 2015 to 226 grams in 2020.

Despite the pandemic, gas generation declined just 4% in 2020. In 2020, the majority of the decline in fossil fuels was in coal, not gas, since a solid carbon price made gas generation the cheapest type of fossil power, even undercutting lignite for the first time in many months. Nuclear production decreased by 10% in 2020 – the greatest decline in history – and this also prevented gas (and, to a lesser degree, coal) production from decreasing more. Wind and solar development have pushed coal into decline, but it's just the start. Europe is counting on wind and solar energy to not just phase out coal by 2030, but also to phase out gas production, substitute closed nuclear energy installations, and satisfy increased electricity usage from electric vehicles, heating systems, etc.

Comparing the 2020 and 2019 data, the COVID-19 pandemic and supply shortages in the supply chain of fossil resources enabled important decisions to be taken on a national and international basis for a clean and sustainable environment. Countries increased their share of clean and renewable energy investments and started new projects. In order to ensure the sustainability of the energy they need and to reduce foreign dependency, more awareness has begun to emerge on renewable energy. The results of the study show that while the energy preferences of the countries in the 2020 pandemic period are in favor of renewable energy, the analysis scores are better compared to 2019. On the contrary, Turkey's 2019 score is slightly better than in 2020. This shows that Turkey should attach importance to the development of policies, projects and action plan similar to the trend of the world, rather than fossil fuels.

The countries that are dependent on foreign energy must replace this dependency with alternative energy sources suitable for their geography and resources in order to have a more sustainable economic system, stable inflation level and standard of living. As of January 2022 in Turkey, fuel prices have nearly doubled compared to 5 months ago. Turkey's energy imports were approximately 55 billion dollars in 2021. While the average over the previous decade has been 45 billion dollars, this rise is due to increased natural gas usage and higher unit pricing Therefore, it is expected that the bill and price paid by the citizen will increase gradually. It is predicted that this amount will increase even more in 2022. Turkey imports 250 billion dollars annually. Thus, energy imports totaling 55 billion dollars account for 22% of Turkey's overall imports. Due to the current account deficit and inflationary implications of foreign dependence on energy supplies, it poses a significant danger to financial sustainability and social wellbeing of countries. In this instance, Turkey has ratified the Kyoto Protocol as of 28 May 2009, so the use of nuclear energy is also very important in terms of meeting the obligations for the prevention of climate change. The first nuclear power plant to be implemented in Turkey will be Akkuyu Nuclear Power Plant with a capacity of 4800 MW to be established in Mersin's Gülnar district. After that, it is aimed to establish the Sinop Nuclear Power Plant with a capacity of 4400 MW to be established in Sinop.

As highlighted in the introduction, oil and its products saw their lowest values in history during the pandemic period. The increase in the production and consumption of renewable energy shows that countries that generate income from oil should create alternative income sources and invest in different sectors in terms of a sustainable economy.

The results of this and similar studies show that this period is an opportunity to direct and support the economy towards renewable energy sources, circular economy, and environmentally friendly transportation systems rather than oil. These developments will allow positive developments to emerge in emissions, public health, employment and many other environmental and other economic issues.

In future studies, the results obtained by different methods can be compared with this study. In addition, the study can be extended by using the data of countries such as China, India and Russia, which do not currently have data for some of the indicators used in this study.

References

aenerji. (2021). *Renewable energy projects.* Retrieved July 2, 2021, from https://aenerji.com/yenilenebilir-enerji-projeleri/

Apan, M., Öztel, A., & İslamoğlu, M. (2015). Teknoloji sektörünün entropi ağırlıklı uzlaşık programlama (CP) ile finansal performans analizi: BİST'de bir uygulama. *19th Finance Symposium*, Hitit University Çorum, Turkey [online] https://www.researchgate.net/publication/283299704 (accessed 7 December 2017).

Behzadian, M., Kazemzadeh, R. B., Albadvi, A., & Aghdasi, M. (2010). PROMETHEE: A comprehensive literature review on methodologies and applications. *European journal of operational research*, *200*(1), 198-215.

Brans, J.-P., & Mareschal, B. (2005). PROMETHEE methods. In J. Figueira, S. Greco & M. Ehrgott (Eds.), *Multiple criteria decision analysis: State of the art surveys* (pp. 163-186). Springer.

Brans, J.-P., & Vincke, P. (1985). Note-A preference ranking organisation method: (The PROMETHEE method for multiple criteria decision-making). *Management science*, *31*(6), 647-656.

Burg, J. P. (1974). Maximum entropy spectral analysis. *Astronomy and Astrophysics Supplement*, *15*, 383.

Canedo, M. M. L., & de Almeida, A. T. (2008). Electronic government: A multi-criterion approach to prioritizing projects by integrating balanced scorecard methodology indicators. *Brazilian Journal of Operations & Production Management*, *5*(2), 49-72.

Dağdeviren, M., & Erarslan, E. (2008). PROMETHEE sıralama yöntemi ile tedarikçi seçimi. *Gazi Üniversitesi Mühendislik-Mimarlık Fakültesi Dergisi*, *23*(1).

Digkoglou, P., & Papathanasiou, J. (2018). Ranking the EU countries according to the environmental performance index using PROMETHEE. *International Journal of Sustainable Agricultural Management and Informatics*, *4*(3-4), 290-305.

Enerdata. (2020). *Global energy statistical yearbook 2020*. Enerdata Grenoble, France. Retrieved September 01, 2021 from https://yearbook.enerdata.net/

Ember and Agora Energiewende. (2020). *EU power sector in 2020*. Retrieved January 25,.2021 from https://ember-climate.org/project/eu-power-sector-2020/

Ergen, E., & Nazlıgül, H. (2021). Energy criticism of Turkey and comparison with the world: Energy harvesting, development, challenges, and opportunities. *Artıbilim: Adana Alparslan Türkeş Bilim ve Teknoloji Üniversitesi Fen Bilimleri Dergisi*, *4*(1), 43-54.

Ernst & Young. (2020). *Recovery in the renewable energy sector*. Retrieved July 12, 2021, from https://www.ey.com/tr_tr/news/2020/ey-yenilenebilir-enerji-ulke-cekiciligi-endeksi-basin-bulteni

Global Economy. (2021). *Compare countries with annual data from official sources.* Retrieved June 15, 2021 from https://www.theglobaleconomy.com/compare-countries/

Golan, A., Judge, G., & Miller, D. (1997). The maximum entropy approach to estimation and inference, in *Applying maximum entropy to econometric problems*. Emerald Group Publishing Limited.

Guler, E., Yerel Kandemir, S., Acikkalp, E., & Ahmadi, M. H. (2021). Evaluation of sustainable energy performance for OECD countries. *Energy Sources, Part B: Economics, Planning, and Policy*, *16*(6), 491-514.

Güneş, İ. (2018). *Türkiye'nin enerji kaynaklari: Güneş*. Retrieved July 18, 2021, from http://ankaenstitusu.com/turkiyenin-enerji-kaynaklari-gunes/

Hoang, A. T., Nižetić, S., Olcer, A. I., Ong, H. C., Chen, W.-H., Chong, C. T., Thomas, S., Bandh, S. A., & Nguyen, X. P. (2021). Impacts of COVID-19 pandemic on the global energy system and the shift progress to renewable energy: Opportunities, challenges, and policy implications. *Energy Policy*, *154*, 112322.

Hosseini, S. E. (2020). An outlook on the global development of renewable and sustainable energy at the time of COVID-19. *Energy Research & Social Science*, *68*, 101633.

IEA, International Energy Agency. (2020). *World energy balances: Overview*. https://www.iea.org/reports/world-energy-balances-overview

IRENA, International Renewable Energy Agency. (2021). *Renewable capacity statistics 2021*. Retrieved April 17, 2021 from https://www.irena.org/publications/2021/March/Renewable-Capacity-Statistics-2021

Ishizaka, A., & Nemery, P. (2011). Selecting the best statistical distribution with PROMETHEE and GAIA. *Computers & Industrial Engineering*, *61*(4), 958-969.

Kahraman, Ç., Abdulhamit, E., & Özevin, O. (2017). Futbol takımlarının finansal ve sportif etkinliklerinin entropi ve TOPSIS yöntemiyle analiz edilmesi: Avrupa'nın 5 büyük ligi ve süper lig üzerine bir uygulama. *Uluslararası Yönetim İktisat ve İşletme Dergisi*, *13*(1), 199-222.

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.

Lee, H.-C., & Chang, C.-T. (2018). Comparative analysis of MCDM methods for ranking renewable energy sources in Taiwan. *Renewable and sustainable energy reviews*, *92*, 883-896.

Lihong, M., Yanping, Z., & Zhiwei, Z. (2008). Improved VIKOR algorithm based on AHP and Shannon entropy in the selection of thermal power enterprise's coal suppliers. In 2008 *International Conference on Information Management, Innovation Management and Industrial Engineering* (Vol. 2, pp. 129-133). IEEE. DOI: 10.1109/ICIII.2008.29. Retrieved July 22, 2021 from https://ieeexplore.ieee.org/abstract/document/4737616?casa_token=BTalRgA3gIoAAAAA:Y-PsnQkz3ciTQgYLyNKune7j-r9yLn0zfkGbYbptUvIKLYQledm1UhSMvS7ylWIMTzIfwO_pVg

Looney, B. (2020). *BP statistical review of world energy. BP Statistical Review*, London UK. Retrieved November 18,.2021 from https://www.bp.com/content/dam/bp/businesssites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2020-full-report.pdf

Mareschal, B., & Brans, J.-P. (1988). Geometrical representations for MCDA. *European journal of operational research*, *34*(1), 69-77.

Mareschal, B., Brans, J. P., & Vincke, P. (1984). *Prométhée: A new family of outranking methods in multicriteria analysis.* Retrieved February 13, 2020 from https://ideas.repec.org/p/ulb/ulbeco/2013-9305.html

Naderipour, A., Abdul-Malek, Z., Ahmad, N. A., Kamyab, H., Ashokkumar, V., Ngamcharussrivichai, C., & Chelliapan, S. (2020). Effect of COVID-19 virus on reducing GHG emission and increasing energy generated by renewable energy sources: A brief study in Malaysian context. *Environmental Technology & Innovation*, *20*, 101151.

NEUPGM, Nükleer Enerji ve Uluslararası Projeler Genel Müdürlüğü. (2021). *Ülkemizde ve dünyada nükleer santraller.* Retrieved September 13, 2021 from https://enerji.gov.tr/neupgm-ulkemizde-ve-dunyada-nukleer-santraller

Phillis, A., Grigoroudis, E., & Kouikoglou, V. S. (2021). Assessing national energy sustainability using multiple criteria decision analysis. *International Journal of Sustainable Development & World Ecology*, *28*(1), 18-35.

Remeikienė, R., Gasparėnienė, L., Fedajev, A., Szarucki, M., Đekić, M., & Razumienė, J. (2021). Evaluation of sustainable energy development progress in EU member states in the context of building renovation. *Energies*, *14*(14), 4209.

Rita, E., Chizoo, E., & Cyril, U. S. (2021). Sustaining COVID-19 pandemic lockdown era air pollution impact through utilization of more renewable energy resources. *Heliyon*, *7*(7), e07455.

Rosenfeld, R. (1994). *Adaptive statistical language modelling.* [PhD Thesis, Carnegie Mellon University]. Retrieved April 17, 2021 from https://www.cs.cmu.edu/~roni/papers/me-csl-revised.pdf

Shannon, C., & Weaver, W. (1949). *The mathematical theory of communication.* University of Illinois Press.

Sharif, A., Baris-Tuzemen, O., Uzuner, G., Ozturk, I., & Sinha, A. (2020). Revisiting the role of renewable and non-renewable energy consumption on Turkey's ecological footprint: Evidence from Quantile ARDL approach. *Sustainable cities and society*, *57*, 102138.

Shemshadi, A., Shirazi, H., Toreihi, M., & Tarokh, M. J. (2011). A fuzzy VIKOR method for supplier selection based on entropy measure for objective weighting. *Expert systems with applications*, *38*(10), 12160-12167.

TENMAK. (2021). *What is the effect of nuclear power plants on global warming?* Retrieved September 15, 2021, from https://www.tenmak.gov.tr/sik-sorulan-sorular/136-nukleer-enerji-ve-nukleer-reaktorler-sss/845-nukleer-santrallerin-kuresel-isinmaya-etkisi-ne-kadardir.html#:~:text=N%C3%BCkleer%20enerjinin%20iklim%20de%C4%9Fi%C5%9Fikli%C4%9Fine%20sebep,olarak%20yakla%C5%9F%C4%B1k%20%17%20tasarruf%20sa%C4%9Flamaktad%C4%B1r.

Tolga, G. (2013). PROMETHEE yöntemi ve GAIA düzlemi. *Afyon Kocatepe Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, *15*(1), 133-154.

Tsiaras, S., & Andreopoulou, Z. (2020). Forest policy evaluation in European countries using the PROMETHEE method. In A. S. N. Mladenović, M. Kuzmanović (Eds.), *Advances in Operational Research in the Balkans* (pp. 95-109). Springer.

Wang, C.-N., Dang, T.-T., Tibo, H., & Duong, D.-H. (2021). Assessing renewable energy production capabilities using DEA window and fuzzy TOPSIS model. *Symmetry*, *13*(2), 334.

Wang, T.-C., & Lee, H.-D. (2009). Developing a fuzzy TOPSIS approach based on subjective weights and objective weights. *Expert systems with applications*, *36*(5), 8980-8985.

World Bank. (2020). *Outlook, Commodity Markets. Washington, DC, USA* Retrieved May 11, 2021 from https://openknowledge.worldbank.org/handle/10986/33624

Yaralıoğlu, K. (2010). *Karar verme yöntemleri*. Detay Yayıncılık.

Zeleny, M. (2012). *Multiple criteria decision making Kyoto 1975* (Vol. 123). Springer Science & Business Media.

Appendix A

Entropy Decision Matrix

	Gasoline consumption, thousand barrels per day	Fossil fuels electricity generation, billion kilowatthours	Coal consumption, thousand short tons	Coal imports, thousand short tons	Wind electricity generation, billion kilowatthours	Solar electricity generation, billion kilowatthours	Hydroelectricity generation, billion kilowatthours	Nuclear power generation, billion kilowatthours	Geothermal electricity generation, billion kilowatthours	Renewable power generation, billion kilowatthours
Countries	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**	**C10**
Australia '20	266.45	183.51	106908.64	183.34	20.4	21.03	16.2	0.1	0.01	57.3
Australia '19	306.61	198.66	112009.02	135.33	17.71	14.85	15.54	0.1	0.01	54.4
Austria '20	31.56	12.53	3218.17	3285.21	6.79	2.04	40.95	0.1	0.01	54.49
Austria '19	38.2	15.01	3520.34	4103.24	7.48	1.7	40.44	0.1	0.01	54.32
Belgium '20	37.41	28.35	3312.22	3599.28	12.87	4.97	0.33	32.6	0.01	23.98
Belgium '19	44.7	26.99	4039.19	4087.15	9.73	4.25	0.11	41.42	0.01	20.04
Canada '20	753.92	103.85	25173.45	6935.84	36.1	4.28	383	92.64	0.01	430.68
Canada '19	875.19	112.9	32227.13	8952.4	32.66	4.08	377.98	94.85	0.01	423.82
Chile '20	68.67	41.44	11333.19	11688.59	5.52	7.62	20.58	0.1	0.25	38.18
Chile '19	80.04	42.86	13063.58	11490.77	4.9	6.14	20.67	0.1	0.2	36.44
Czechia '20	33.9	35.51	38820.23	3950.28	0.7	2.24	2.15	28.37	0.01	9.9
Czechia '19	37.41	40.71	45963.68	4208.91	0.7	2.26	1.99	28.58	0.01	10.14
Denmark '20	28.7	4.21	1363.66	1224.66	16.35	1.18	0.02	0.1	0.01	23.24
Denmark '19	30.72	5.27	1740.49	2631.6	16.15	0.96	0.02	0.1	0.01	24.01
Estonia '20	5.02	3.29	3.82	3.82	0.84	0.12	0.04	0.1	0.01	1.77
Estonia '19	6.35	4.61	19.61	19.61	0.69	0.07	0.02	0.1	0.01	2.19
Finland '20	30.75	8.98	2911.2	2603.99	7.94	0.26	15.65	22.36	0.01	34.59
Finland '19	32.8	11.46	3923.45	3392.37	6.03	0.15	12.31	22.92	0.01	32.3
France '20	174.19	44.55	8749.7	8194.92	40.7	13.58	60.75	335.41	0.13	129.27
France '19	203.36	48.21	10897.19	11588.67	34.72	12.23	56.98	382.4	0.13	118.59
Germany '20	452.68	221.66	151834.66	32963.5	130.97	50.6	19.27	60.92	0.22	253.14
Germany '19	495.52	257.9	188824.59	45577.35	125.89	46.39	19.86	70.98	0.2	246.54
Greece '20	43.96	22.94	15242.35	335.49	9.32	4.36	3.38	0.1	0.0001	17.7
Greece '19	52.82	27.91	29691.11	359.92	7.27	4.43	3.98	0.1	0.0001	17.08
Hungary '20	31.31	11.91	8243.07	1529.02	0.66	2.45	0.24	15.17	0.02	5.6
Hungary '19	34.96	11.81	9143.66	1790.97	0.73	1.5	0.22	15.41	0.02	4.94
Iceland '20	2.37	0.0001	141.85	135.64	0.01	0.001	13.03	0.1	5.96	18.91
Iceland '19	2.9	0.0001	156.93	164.9	0.01	0.001	13.32	0.1	6.02	19.26
Ireland '20	13.25	19.17	378.3	440.71	11.55	0.06	0.95	0.1	0.01	12.22
Ireland '19	17.78	17.99	643.74	393.85	10.02	0.02	0.88	0.1	0.01	11.43
Israel '20	62.21	64.2	5609.99	6133.85	0.23	4.07	0.01	0.1	0.01	0.1
Israel '19	71.7	64.67	6499.65	6499.75	0.18	3.29	0.01	0.1	0.01	0.1
Italy '20	136.8	152.36	8518.4	8606.13	18.7	24.94	45.44	0.1	6.03	117.28
Italy '19	176.53	165.7	11425.19	11933.27	20.2	23.71	45.32	0.1	6.08	117.05
Japan '20	756.4	655.13	203062.19	191439.48	8.65	78.64	85.5	40.81	2.85	257.21
Japan '19	853.65	698.91	206516.8	205232.69	7.67	68.95	79.82	65.68	2.83	225.54
Latvia '20	4.3	1.82	43.3	43.73	0.18	0.01	2.57	0.1	0.01	3.55
Latvia '19	4.28	2.89	74.37	87.47	0.15	0.001	2.09	0.1	0.01	3.17
Lithuania '20	5.86	1.66	223.7	276.01	1.55	0.13	0.39	0.1	0.01	2.62
Lithuania '19	5.78	0.51	289.58	408.72	1.5	0.09	0.34	0.1	0.01	2.53
Luxembourg '20	6.37	0.17	71.93	81	0.34	0.18	0.12	0.1	0.01	1.01
Luxembourg '19	8.33	0.19	70.67	78.59	0.28	0.13	0.11	0.1	0.01	0.8
Mexico '20	546.78	231.26	9281.45	4581.78	19.7	13.53	27.11	11.09	4.52	65.73
Mexico '19	752.53	250.08	18533.14	8867.71	16.88	7.06	23.85	10.88	5.35	55.36
Netherlands '20	85.49	80.27	7196.69	23469.18	15.34	7.99	0.05	3.86	0.01	30.25
Netherlands '19	100.27	88.95	11232.54	41513.99	11.51	5.16	0.07	3.7	0.01	22.7
New Zealand '20	50.81	8.51	2847.28	1189.76	2.3	0.16	23.73	0.1	8.14	34.37
New Zealand '19	56.59	7.62	2940.8	1184.59	2.25	0.13	25.33	0.1	7.44	35.77
Norway '20	16.75	1.83	904.33	902.48	9.91	0.03	139.18	0.1	0.01	149.67
Norway '19	17.72	2.5	888.3	874.95	5.54	0.01	123.66	0.1	0.01	129.65
Poland '20	101.73	116.72	119540.52	14416.79	15.8	1.99	2.15	0.1	0.01	27.66
Poland '19	109.16	125.47	131484.3	18764.99	15.11	0.71	1.94	0.1	0.01	25.14
Portugal '20	20.98	20.59	1046.5	253.16	12.26	1.68	11.87	0.1	0.22	29.66
Portugal '19	24.71	23.37	2321.3	3135.35	13.67	1.34	8.65	0.1	0.22	27.3
Slovakia '20	12.09	5.49	4562.46	3241.99	0.01	0.66	4.47	14.05	0.01	6.69
Slovakia '19	13.06	5.56	5708.86	4199.84	0.01	0.59	4.27	14.28	0.01	6.16
Slovenia '20	7.41	4.46	3835.69	345.1	0.01	0.37	5.02	6.04	0.01	5.59
Slovenia '19	9.28	4.53	3830.23	481.59	0.01	0.3	4.43	5.53	0.01	5
South Korea '20	218.37	357.04	138064.78	136127.44	3.15	18.25	3.2	152.3	0.01	45.26
South Korea '19	226.71	390.78	146354.91	155861.94	2.68	13.02	2.75	138.81	0.01	31.21
Spain '20	97.98	82.55	3960	4375.26	56.27	20.54	30.59	55.76	0.01	112.19
Spain '19	124.44	106.33	8460	9467.65	55.65	15.1	24.23	55.86	0.01	100.26
Sweden '20	48.46	0.17	2347.92	2231.68	27.53	1.04	71.04	47.26	0.01	111.4
Sweden '19	51.08	1.63	2631.21	2574.86	19.85	0.68	64.47	64.43	0.01	98.56
Switzerland '20	47.83	0.52	151.29	138.68	0.15	2.52	37.72	22.99	0.01	43.3
Switzerland '19	54	0.61	158.91	139.37	0.15	2.18	37.66	25.37	0.01	43.22
Turkey '20	54.45	165.04	113734.81	44363.5	24.7	11.27	77.2	0.1	9.93	124.65
Turkey '19	54.03	158.7	137176	41615.14	21.73	9.25	88	0.1	8.95	130.21
United Kingdom '20	221.82	113.33	7795.56	4990.53	75.61	12.8	5.92	45.67	0.01	137.41
United Kingdom '19	285.02	134.13	8797.02	6866.27	64.34	12.68	5.9	51.03	0.01	124.61
USA '20	8033.7	2419.23	535400	5350	337.51	132.63	291.11	789.92	16.93	847
USA '19	9309.34	2581.7	588414.63	6696.53	295.88	106.89	287.87	809.41	15.47	776.96

Appendix B

PROMETHEE Decision Matrix

Countries	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
Australia '20	0.971626	0.928919	0.818316	0.999125	0.060415	0.158555	0.042273	0	0.000585	0.06754
Australia '19	0.967311	0.923051	0.809648	0.999359	0.052444	0.111959	0.040549	0	0.000585	0.064116
Austria '20	0.996864	0.995147	0.994537	0.984011	0.020089	0.015374	0.106896	0	0.000585	0.064222
Austria '19	0.99615	0.994186	0.994024	0.980025	0.022133	0.01281	0.105564	0	0.000585	0.064022
Belgium '20	0.996235	0.989019	0.994377	0.982481	0.038104	0.037465	0.000836	0.040158	0.000585	0.028197
Belgium '19	0.995452	0.989546	0.993142	0.980104	0.0288	0.032037	0.000261	0.051056	0.000585	0.023545
Canada '20	0.919249	0.959775	0.957224	0.966223	0.106933	0.032263	1	0.114344	0.000585	0.508419
Canada '19	0.906219	0.956269	0.945237	0.956397	0.096741	0.030755	0.986893	0.117075	0.000585	0.500319
Chile '20	0.992876	0.983949	0.980746	0.943065	0.016326	0.057446	0.053709	0	0.014761	0.044964
Chile '19	0.991655	0.983399	0.977805	0.944029	0.014489	0.046287	0.053944	0	0.011808	0.042909
Czechia '20	0.996612	0.986246	0.934032	0.98077	0.002044	0.016882	0.005588	0.034931	0.000585	0.011572
Czechia '19	0.996235	0.984231	0.921892	0.97951	0.002044	0.017032	0.00517	0.03519	0.000585	0.011855
Denmark '20	0.997171	0.998369	0.997689	0.994051	0.048415	0.008889	0.000104	0	0.000585	0.027323
Denmark '19	0.996954	0.997959	0.997049	0.987196	0.047822	0.007231	0.000104	0	0.000585	0.028232
Estonia '20	0.999715	0.998726	1	1	0.002459	0.000897	0.000104	0	0.000585	0.001972
Estonia '19	0.999572	0.998214	0.999973	0.999923	0.002015	0.00052	0.000104	0	0.000585	0.002468
Finland '20	0.996951	0.996522	0.995059	0.98733	0.023496	0.001953	0.040837	0.027505	0.000585	0.040725
Finland '19	0.99673	0.995561	0.993339	0.983489	0.017837	0.001123	0.032116	0.028197	0.000585	0.038021
France '20	0.981539	0.982744	0.985136	0.960088	0.120563	0.102383	0.158594	0.414316	0.007673	0.152521
France '19	0.978404	0.981326	0.981487	0.943552	0.102844	0.092205	0.148751	0.472378	0.007673	0.13991
Germany '20	0.951616	0.914142	0.741965	0.8394	0.38803	0.381508	0.050289	0.07515	0.012989	0.298784
Germany '19	0.947013	0.900105	0.6791	0.777938	0.372978	0.349765	0.051829	0.087581	0.011808	0.290991
Greece '20	0.995531	0.991114	0.974102	0.998384	0.027585	0.032866	0.008799	0	0	0.020782
Greece '19	0.994579	0.989189	0.949547	0.998265	0.021511	0.033394	0.010366	0	0	0.02005
Hungary '20	0.996891	0.995387	0.985997	0.992568	0.001926	0.018465	0.000601	0.018621	0.001175	0.006494
Hungary '19	0.996498	0.995426	0.984467	0.991292	0.002133	0.011302	0.000548	0.018917	0.001175	0.005715
Iceland '20	1	1	0.999765	0.999358	0	0	0.033996	0	0.352034	0.02221
Iceland '19	0.999943	1	0.99974	0.999215	0	0	0.034753	0	0.355578	0.022624
Ireland '20	0.998831	0.992575	0.999364	0.997871	0.034193	0.000445	0.002454	0	0.000585	0.014311
Ireland '19	0.998344	0.993032	0.998912	0.9981	0.029659	0.000143	0.002272	0	0.000585	0.013378
Israel '20	0.99357	0.975133	0.990472	0.970131	0.000652	0.03068	0	0	0.000585	0
Israel '19	0.992551	0.974951	0.98896	0.968348	0.000504	0.024798	0	0	0.000585	0
Italy '20	0.985556	0.940985	0.98553	0.958084	0.055378	0.188036	0.118619	0	0.356169	0.138363
Italy '19	0.981287	0.935818	0.980589	0.941872	0.059822	0.178762	0.118306	0	0.359122	0.138092
Japan '20	0.918982	0.746241	0.654904	0.067209	0.0256	0.592925	0.223217	0.050302	0.168335	0.30359
Japan '19	0.908533	0.729283	0.649033	0	0.022696	0.519864	0.208387	0.081032	0.167154	0.266194
Latvia '20	0.999793	0.999295	0.999933	0.999806	0.000504	0.000143	0.006684	0	0.000585	0.004074
Latvia '19	0.999795	0.998881	0.99988	0.999592	0.000415	0.000143	0.005431	0	0.000585	0.003625
Lithuania '20	0.999625	0.999357	0.999626	0.998674	0.004563	0.000973	0.000992	0	0.000585	0.002976
Lithuania '19	0.999634	0.999802	0.999514	0.998027	0.004415	0.000671	0.000862	0	0.000585	0.002869
Luxembourg '20	0.99957	0.999934	0.999884	0.999624	0.000978	0.00135	0.000287	0	0.000585	0.001075
Luxembourg '19	0.99936	0.999926	0.999886	0.999636	0.0008	0.000973	0.000261	0	0.000585	0.000827
Mexico '20	0.941505	0.910423	0.984233	0.977693	0.058341	0.102006	0.070759	0.013579	0.266977	0.077494
Mexico '19	0.919398	0.903134	0.96851	0.95681	0.049985	0.053224	0.062247	0.01332	0.316003	0.06525
Netherlands '20	0.991069	0.968908	0.987776	0.885662	0.045422	0.060236	0.000104	0.004646	0.000585	0.0356
Netherlands '19	0.989481	0.965546	0.980917	0.797737	0.034074	0.038898	0.000157	0.004448	0.000585	0.026686
New Zealand '20	0.994795	0.996704	0.995168	0.994221	0.006785	0.001199	0.061934	0	0.4808	0.040465
New Zealand '19	0.994174	0.997048	0.995009	0.994247	0.006637	0.000973	0.066111	0	0.439453	0.042118
Norway '20	0.998455	0.999291	0.99847	0.995621	0.029333	0.000219	0.363378	0	0.000585	0.176609
Norway '19	0.998351	0.999032	0.998497	0.995755	0.016385	0.000106	0.322854	0	0.000585	0.15297
Poland '20	0.989324	0.95479	0.796848	0.929771	0.046785	0.014997	0.005588	0	0.000585	0.032542
Poland '19	0.988526	0.9514	0.77655	0.908584	0.044741	0.005346	0.005039	0	0.000585	0.029567
Portugal '20	0.998	0.992025	0.998228	0.998785	0.036296	0.012659	0.030967	0	0.012989	0.034904
Portugal '19	0.9976	0.990948	0.996061	0.984741	0.040474	0.010096	0.022559	0	0.012989	0.032117
Slovakia '20	0.998956	0.997874	0.992253	0.984222	0	0.004969	0.011645	0.017237	0.000585	0.007781
Slovakia '19	0.998851	0.997846	0.990304	0.979554	0	0.004441	0.011123	0.017521	0.000585	0.007156
Slovenia '20	0.999458	0.998272	0.993488	0.998337	0	0.002782	0.013081	0.00734	0.000585	0.006482
Slovenia '19	0.999258	0.998245	0.993497	0.997672	0	0.002254	0.011541	0.006709	0.000585	0.005786
South Korea '20	0.976792	0.861704	0.765366	0.336723	0.009304	0.137594	0.008329	0.188061	0.000585	0.053324
South Korea '19	0.975895	0.848635	0.751277	0.240564	0.007911	0.098161	0.007154	0.171393	0.000585	0.036734
Spain '20	0.989727	0.968025	0.993277	0.9787	0.166696	0.154861	0.079845	0.068775	0.000585	0.132353
Spain '19	0.986884	0.958814	0.985629	0.953886	0.164859	0.113844	0.063239	0.068898	0.000585	0.118267
Sweden '20	0.995048	0.999934	0.996016	0.989145	0.081541	0.007834	0.185462	0.058272	0.000585	0.13142
Sweden '19	0.994766	0.999369	0.995535	0.987472	0.058785	0.00512	0.168307	0.079487	0.000585	0.116259
Switzerland '20	0.995115	0.999799	0.999749	0.999343	0.000415	0.018993	0.098462	0.028283	0.000585	0.05101
Switzerland '19	0.994453	0.999764	0.999736	0.99934	0.000415	0.016429	0.098305	0.031224	0.000585	0.050915
Turkey '20	0.994404	0.936073	0.806715	0.783853	0.073156	0.084966	0.201546	0	0.58653	0.147066
Turkey '19	0.994449	0.938529	0.766877	0.797244	0.064356	0.069736	0.229745	0	0.528645	0.153631
United Kingdom '20	0.976421	0.956103	0.986758	0.975702	0.224	0.096502	0.015431	0.056307	0.000585	0.162132
United Kingdom '19	0.96963	0.948046	0.985056	0.966562	0.190607	0.095597	0.015379	0.06293	0.000585	0.147019
USA '20	0.137063	0.062931	0.090098	0.97395	1	1	0.760072	0.975918	1	1
USA '19	0	0	0	0.967389	0.876652	0.805925	0.751612	1	0.913762	0.917298

ORIGINAL RESEARCH

Curr Res Soc Sci (2022), 8(1) • 29-48

Psychosocial Hazards Faced by Teachers during the COVID-19 Pandemic Period

COVID-19 Pandemi Döneminde Öğretmenlerin Karşılaştıkları Psikososyal Tehlikeler

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Abstract

This study aims to analyze teachers' views about psycho-social hazards faced by teachers who took active roles in the distance education process in the period of the COVID-19 pandemic. The study was performed with the qualitative research method. In the study, a semi-structured interview form created by the researchers was used as a data collection tool. A face-to-face interview was conducted with 19 of the 20 teachers who participated in the study, and a telephone interview was conducted with one. The interviews were recorded with a voice recorder. After records were transcribed, the content analysis was conducted on records. By using the interview form composed of 18 questions, the raw data of the research were collected and analyzed. The themes, "COVID-19 Measures", "Technical Problems", "Change in the way of working", "Relations with School Administration and Co-Workers", "The Effect of Teleworking on Work-Life Balance", and "Negative Effects of Teleworking on Health", were created as per the analysis. Upon the examination of themes, it was concluded that the teachers who were obliged to telework in the period of the pandemic were confronted with several psycho-social hazards such as adapting to a new instruction method, preparing lessons at home without receiving any technical support, not being in communication with school administrators and co-workers, and feeling anxiety about covering all topics in the curriculum in due time. In addition, it was observed that none of the teachers participating in the study received technical support. Therefore, according to the results of the study, it can be recommended that teachers receive technical support for changing working styles to cope with these dangers they face during the pandemic period.

Keywords: Psycho-Social Hazard, Pandemic, COVID-19, Distance Education, Technical Support.

Öz

Bu çalışmada COVID-19 pandemi döneminde uzaktan öğretim süreçlerinde aktif rol alan öğretmenlerin, karşılaştıkları psikososyal tehlikelere yönelik görüşlerinin incelenmesi amaçlanmaktadır. Çalışma nitel araştırma yöntemi ile yürütülmüştür. Çalışmada veri toplama aracı olarak araştırmacılar tarafından oluşturulan yarı yapılandırılmış görüşme formu kullanılmıştır. Çalışmaya katılan 20 öğretmenden 19'u ile yüz yüze, biri ile telefonla görüşme yapılmıştır. Yapılan görüşmeler ses kayıt cihazı ile kayıt altına alınmıştır. Kayıtlar transtkript edilerek içerik analizine tabi tutulmuştur. 18 sorudan oluşan görüşme formu ile araştırmanın ham verileri toplanmış ve analiz edilmiştir. Analiz sonucunda "Covid-19 tedbirleri", "Teknik problemler", "Çalışma Şeklindeki Değişiklik", "Yönetim ve iş arkadaşlarıyla ilişkiler", "Evden çalışmanın iş – aile dengesine etkisi" ve "Evden çalışmanın sağlığa olumsuz etkileri" temalarına ulaşılmıştır. Temalar incelendiğinde, pandemi döneminde evden çalışmak zorunda kalan öğretmenlerin, yeni bir öğretim yöntemine uyum sağlama, teknik destek almadan dersleri evden hazırlama, yönetici ve iş arkadaşları iletişim halinde olamama, müfredat yetiştirememe kaygısı gibi birçok psikososyal tehlike ile karşı karşıya kaldıkları sonucuna varılmıştır. Ayrıca çalışmaya katılan öğretmenlerin hiçbirinin teknik destek almadıkları görülmüştür. Dolayısıyla, çalışma sonucuna göre öğretmenlerin pandemi döneminde karşılaştıkları bu tehlikelerle başa çıkabilmeleri için değişen çalışma şekillerine yönelik teknik destek almaları önerilebilir.

Anahtar Kelimeler: Psikososyal Tehlike, Pandemi, COVID-19, Uzaktan Eğitim, Teknik Destek.

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Article Info / Makale Bilgileri:
Received / Gönderim: 30.10.2021 Accepted / Kabul: 30.05.2022

To cite this article / Atıf için:
Senemtaşı Ünal, E., Baykan, P., & Demirci, A. (2021). Psychosocial hazards faced by teachers during the COVID-19 pandemic period. *Curr Res Soc Sci, 8*(1), 29-48.

To link to this article / Bağlantı için:
http://dx.doi.org/10.30613/curesosc.1016487

Introduction

The distance education method was used in Turkey as well to ensure the continuity of education in the period of the pandemic just as in numerous countries across the world (The Ministry of Education, 2020). Going beyond being simply a choice for teachers, distance education and teleworking became a compulsory way of working confronting teachers in the period of the pandemic. Before the pandemic, distance education was used as a technique allowing large masses to access information more quickly and easily. The distance education method that enables individuals to benefit from education and instruction facilities independently and at their own learning speeds by saving time and space and by lowering education costs seems more advantageous than formal education (Demiray, 1999; Cavanaugh, 2000; Elitaş, 2017). However, as distance education has shortfalls in terms of communication and interaction, it is asserted that it brings about certain disadvantages such as the fall in the individual's motivation, social development problems experienced by the individual, and limitations regarding practical courses (Yurdakul, 2015; Elitaş, 2017). The distance education method that is compulsorily implemented in the period of the pandemic is viewed by teachers as the best method to supersede face-to-face education (Sindiani, 2020). However, along with the pandemic, several problems emerged in the distance education process. According to the studies performed in light of the teachers' views in the period of the pandemic, the problems encountered in distance education can be listed as the increasing workload, time management, fall in the work motivation, trouble in accessing course materials, and the rise in costs of technological devices and internet (Giovennalla et al., 2020; Purwanto et al., 2020; Allen et al., 2020; Chang & Satako, 2020). Besides these problems, the circumstances such as having a change in ways of working, having heavy work conditions, using an unconventional instruction method, working longer, and designing course materials different from those in formal education exposed teachers to several psycho-social hazards in the period of the pandemic. As a matter of fact, in previous studies, it was stated that the teachers had anxiety about adapting to this compulsorily changing way of working and instruction method (Košir et al., 2020; Truzoli et al., 2021). The uncertainty arising from the quick transition to distance education negatively affected the teachers who were not technologically and psychologically prepared for this process. The setbacks such as the increase in workload (MacIntyre et al., 2020), lack of technical and pedagogical support (Trust & Whalen, 2020), absence of previous experience, technological incompetence, work-life imbalance, and the inability to focus on work were sources of stress for teachers (Rubin, Nikolaeva, Nello-Deakin, & Brömmelstroet, 2020). In a study, investigated the psychological effects of the problems teachers faced during the Covid 19 pandemic period. They concluded that there are both positive and negative effects. They emphasized that there are effects such as anxiety, family conflict and despair among the negative effects (Eşici et al., 2021).

Upon the review of studies performed during the period of the pandemic, it is discerned that the challenges faced by teachers in the distance education process were examined, however, a small number of studies were performed to identify psycho-social hazards. Thus, examining teachers' emotions, opinions, and perceptions about psycho-social hazards in the process of the pandemic is considered important to the measures to be taken. In this context, this study aims to examine the views that the teachers, who took active roles in the distance education process, had about psycho-social hazards encountered in the period of the pandemic.

The research questions serving as the basis of this study are as below:

1. What are the teachers' views about COVID-19 measures taken at the workplace in the process of the pandemic?
2. What effects do the technical problems experienced by teachers in courses offered via the distance education method have on routine life?
3. What sort of problems does the change in the way of working produce in daily life?

4. How are the teachers' relations with the school administration and co-workers in the period of the pandemic?
5. What are the effects of teleworking system on work-life balance in the period of the pandemic?
6. What are the negative effects of teleworking system on health in the period of the pandemic?

Method

The study aiming at examining the views that the teachers, who took active roles in the distance education process, had about psycho-social hazards encountered in the period of the pandemic was performed by using the qualitative research method. The qualitative research method that aspires to understand a social event from participants' perspectives provides participants with the opportunity to express their views and opinions freely (McMillan & Schumacher, 2010). As the research targeted to conduct an in-depth analysis by examining the factors about a case with a holistic approach by focusing on how the factors affected the case and how the case affected the factors (Stake, 2003), it was designed as a case study based on the qualitative research method. Thus, in this study, teachers' views and opinions about being exposed to psycho-social hazards in the compulsory distance education process in the period of the pandemic will be deeply analyzed.

The study was examined by the Scientific Research Ethics Committee of Ağrı İbrahim Çeçen University, and the ethical endorsement for the research was granted as per the decision issued on 28 June 2021 (No. 171).

Study Group

The study group of this research is comprised of volunteer teachers from different branches and at various levels. In the research, the criterion sampling method, a purposive sampling method, was used for the selection of participants. This sampling method is based on the satisfaction of a series of previously specified criteria. The criterion or criteria can be created by the researcher (Yıldırım & Şimşek, 2011). Hence, the criterion designated for the selection of the sample of this research is whether a teacher performed online distance education activities with students in the period of the pandemic. In this respect, 20 teachers who performed online distance education activities in the process of the pandemic were included in the sample. As the case study is a detailed and comprehensive research method, the number of participants and accordingly the sample size will be relatively small (Yıldırım & Şimşek, 2011). Table 1 displayed participants' socio-demographic characteristics as well as the codenames assigned to participants in the process of analysis.

Table 1

Participants' Socio-Demographic Characteristics

Codename	Gender	Marital status	Branch	Age	Work duration (Year)
T-1	Male	Married	Primary school teaching	30	1
T-2	Male	Married	Primary school math teaching	28	4
T-3	Female	Single	Turkish language teaching	27	3
T-4	Female	Single	Turkish language teaching	23	1
T-5	Male	Single	Social science teaching	27	1
T-6	Female	Single	Art teaching	35	1
T-7	Female	Single	Math teaching	24	1
T-8	Female	Single	Religious culture and moral knowledge teaching	27	3

Table 1

Participants' Socio-Demographic Characteristics (Continued)

Codename	Gender	Marital status	Branch	Age	Work duration (Year)
T-9	Male	Single	Religious culture and moral knowledge teaching	28	3
T-10	Female	Single	Psychological counseling and guidance teaching	25	2
T-11	Male	Married	Physical education and sports teaching	34	9
T-12	Female	Single	Science teaching	25	2
T-13	Female	Single	English language teaching	27	1
T-14	Male	Married	Technology and design teaching	39	11
T-15	Male	Married	Primary school math teaching	27	3
T-16	Female	Single	Turkish language teaching	29	4
T-17	Male	Married	Physical education and sports teaching	30	7
T-18	Male	Married	English language teaching	40	10
T-19	Female	Married	Primary school teaching	39	12
T-20	Female	Married	Primary school teaching	27	5

As per the review of Table 1, 11 of 20 participants were female while the rest of them were male. These participants were from the branches of primary school teaching *(f=3)*, psychological counseling and guidance teaching *(f=1)*, social science teaching *(f=1)*, Turkish language teaching *(f=3)*, religious culture and moral knowledge teaching *(f=2)*, physical education and sports teaching *(f=2)*, technology and design teaching *(f=1)*, art teaching *(f=1)*, English language teaching *(f=2)*, science teaching *(f=1)*, and math teaching *(f=3)*.

Table 2 exhibited the participants' work-related data.

Table 2

Participants' Work-Related Data

Codename	Having administrative duties	Course hours per week	Average work hours per day	Having any technical training about distance education
T-1	—	15-30	4-6	—
T-2	—	15-30	7-9	—
T-3	—	15-30	4-6	—
T-4	—	15-30	4-6	—
T-5	—	15-30	4-6	—
T-6	—	15-30	4-6	Yes
T-7	—	15-30	4-6	—
T-8	—	15-30	4-6	—
T-9	—	15-30	7-9	—
T-10	—	15-30	4-6	Yes

Table 2

Participants' Work-Related Data (Continued)

T-11	—	15-30	4-6	—
T-12	—	15-30	7-9	—
T-13	—	15-30	7-9	—
T-14	—	15-30	4-6	—
T-15	Yes	1-15	7-9	Yes
T-16	—	15-30	7-9	—
T-17	Yes	15-30	7-9	—
T-18	—	15-30	7-9	—
T-19	—	15-30	4-6	—
T-20	—	15-30	4-6	—

Upon the review of Table 2, it is discerned that only 2 teachers had administrative duties, 19 teachers had 15-30 course hours per week whilst 1 teacher had 1-15 course hours per week, 12 teachers had 4-6 work hours per day while 8 teachers had 4-6 work hours per day, none of the teachers received psychological support in the period of the pandemic, and 3 teachers had technical training about the distance education technology whereas 17 teachers had no technical training.

Data Collection Tool and the Process of Data Collection

In the study, the interview method was used as a qualitative data collection method. This method was selected as it was a reciprocal and interactive communication process based on asking questions and giving answers (Yıldırım & Şimşek, 2011) and aimed to collect detailed data.

In the research, the semi-structured interview was utilized to analyze the views that the teachers, who took active roles in the distance education process, had about psycho-social hazards encountered in the period of the pandemic. The semi-structured interview is frequently used in education research as it provides flexibility and standardization for participants (Ekiz, 2009). In this study, the semi-structured interview form was prepared with due attention to the research questions and had three parts. In this respect, the interview form contained 7 questions addressing participants' demographic data in the first part, 5 questions finding out about participants' work-related data in the second part, and 6 open-ended questions designed to identify psycho-social hazards in the third part. In the preparation of semi-structured interview questions, opinions were received from expert teachers, faculty members, workplace doctors, and workplace safety experts. Alternative questions and probing questions were added to the semi-structured interview form. The shortfalls in the semi-structured interview form were identified after the form was applied to 2 teachers in the context of a pilot study, and upon making the necessary corrections, the latest version of the form was created.

After identifying the periods when the participants were available, the semi-structured interview form was applied to participants. The interviews were held face-to-face with 19 teachers and via a phone call with one teacher. Taking approximately 10-15 minutes, each interview was recorded with a voice recorder upon receiving permission from each participant. The texts of statements made in interviews were created without making corrections and adding comments to the statements. As the teachers were to be quoted in research findings, a codename was assigned to each teacher (T-1, T-2, and so on).

Data Analysis

The collected data were analyzed by using the qualitative data analysis method. The qualitative data analysis is utilized to make a general evaluation of the relationship between the categories of data (Marshall & Rossman, 1994). The content analysis, a qualitative analysis method, was used to find out concepts and relationships that would explain the data collected in the study (Yıldırım & Şimşek, 2011). To organize the research data, the categories and codes were created with inductive analysis. The categories were produced along with the classification of obtained concepts under a specific theme whilst codes were generated by giving names to meaningful parts in the collected data (Yıldırım & Şimşek, 2011).

Validity and Reliability

To ensure the validity and reliability of the research, efforts were made to enhance credibility, transferability, and consistency (Lincoln & Guba, 1985; Merriam, 1998). In the context of promoting the credibility of the research, the directly quoted statements were included in the study, next, the coding was performed also by other experts, and efforts were made to reach a consensus on coding, and also, participation in the research was voluntary for teachers. Besides, the participants were told that the confidentiality of the collected data would be protected and the collected data would not be shared with any third party or institution. To ensure transferability in the study, the reason for using the above-mentioned method in the research was explained, the characteristics of the study group were presented in detail without violating the principle of confidentiality, and also, the application process of data collection tools and the data analysis were addressed in detail. All interviews were recorded, and each researcher separately controlled the collected data, and hence, efforts were made to enhance consistency in the analysis. To measure consistency, the formula by Miles and Huberman (1994) was used [Reliability= Agreement / (Agreement+Disagreement) * 100], and the codes with the level of agreement above 0.70 were deemed reliable. The codes were created individually by 3 researchers from raw data. The first researcher produced a total of 45 codes, the second researcher created 44 codes, and the third researcher identified 40 codes. The first and second researchers agreed on 38 codes and disagreed on 8 codes, the second and third researchers agreed on 35 codes and disagreed on 5 codes, and lastly, the first and third researchers agreed on 40 codes and disagreed on 6 codes. In this context, the level of agreement between the first and second researchers was 0.83, the level of agreement between the first and third researchers was 0.87, the level of agreement between the second and third researchers was 0.87, and the level of agreement between the three researchers was around 0.86. Thus, it is discerned that the codes were created on the basis of research questions, and there was an agreement between all three researchers who performed coding with the thematic coding approach.

The validity of the data collection tool should be assured by taking into consideration that the data collection tool would include all variables to be measured (McMillan & Schumacher, 2010). The development process of the data collection tool was based, in general, on the relevant literature and, in particular, on the informative guideline prepared by the World Health Organization to eliminate psycho-social risks. Besides, in the preparation of the data collection tool, opinions were received from expert teachers, faculty members, workplace doctors, and workplace safety experts. By making the necessary arrangements, it was assured that each question in the data collection tool reflected the intended opinion. The questions in the data collection tool were prepared in a manner to cover the research aim and research questions.

Findings

The findings based on the analysis of the data that were collected to identify the psycho-social hazards encountered in the process of the COVID-19 pandemic according to teachers' views were presented successively in parallel to research questions.

Teachers' Views about Covid-19 Measures Taken at the Workplace in the Process of the Pandemic

The views of teachers regarding the covid-19 measures taken in the workplace during the pandemic process are presented in Table 3.

Table 3

Participants' Views about Covid-19 Measures Taken at the Workplace in the Process of the Pandemic

Theme	Category	Code	Frequency
COVID-19 measures	Measures taken by the school administration	Adequate	13
		Inadequate	7
	Problems stemming from students	Not abiding by the rules about mask use and hygiene	6
		Not being attentive to social distancing	7
		Having crowded classrooms	7
	Emotional effects	Uneasiness	11

As viewed in Table 3, participants' views about COVID-19 measures taken at the workplace are grouped under three categories. These categories are, firstly, the measures taken by the school administration, secondly, problems stemming from students, and thirdly, emotional effects.

Alongside the examination of the first category, ***measures taken by the school administration***, it was found that 65% of the teachers said that the measures were adequate whereas 35% of them told that the measures were inadequate. Examples of view reflecting teachers' answers are as below:

T-2 :"We took the necessary measures at our school. However, I do not find them adequate. The hazard continues. Regarding students, there are certain things that escape our attention, however hard we try. This, in turn, inevitably leads to uneasiness."

Upon the review of the second category, ***problems stemming from students***, it is discerned that all participants said that they experienced problems stemming from students in the process of the pandemic. In this regard, 6 teachers told that the students did not abide by the rules about mask use and hygiene, 7 teachers said that the students were not attentive to social distancing, and 7 teachers stated that they experienced problems as the classrooms were crowded. Examples of view reflecting teachers' answers are as below:

T-10: "In general, as the school administration and teachers, we took the measures that were supposed to be taken at the school. However, they were not adequate. There were things that could not be done due to certain impossibilities that went beyond our control. Besides, solely taking measures is not enough. It is necessary to inform the student about measures. Problems are experienced in the practice of measures. We wonder whether the student will infect us with the virus or the students will infect each other with the virus. Students do not pay attention to social distancing and mask use.".

As per the analysis of the third and last category, ***emotional effects***, it is identified that 55% of the participants asserted that they felt uneasy due to the problems at the workplace. Examples of views reflecting teachers' answers are as below:

T-3: "At the workplace, measures were taken but I felt uneasy as the school was crowded. I wonder if I was infected with the disease or not".

T-5 :"We have a crowded school. We are always in contact with students. We took the necessary measures on this topic. Even so, problematic situations are experienced. People become uneasy. I constantly feel myself at risk."

According to the analysis of participants' views about COVID-19 measures taken at the workplace as per Table 3, the majority of teachers find the measures of school administration adequate. On the other hand, all teachers state that, on the topics of mask use, social distancing, and hygiene, they had problems stemming from students, and hence, they felt uneasy.

Effects of Technical Problems, Which are experienced by Teachers in Courses Lectured with the Distance Education Method, on the Routine Life

Effects of technical problems, which are experienced by teachers in courses lectured with the distance education method, on the routine life are presented in Table 4.

Tablo 4

Effects of Technical Problems in Distance Education on Daily Life

Theme	Category	Code	Frequency
Technical problems	Emotional effects	Getting tired	4
		Having stress	6
		Getting bored	5
		Feeling angry	4
	Attitude toward the course	Motivation deficiency	8
		Decrease in willingness to teach lessons	7
		Anxiety about covering course topics in due time	4

As viewed in Table 4, teachers' views about the effects of technical problems in courses in distance education on routine life are grouped under two categories. These categories are, firstly, the emotional effects, and secondly, the attitude toward the course.

Along with the examination of the first category, ***emotional effects***, it is found that 95% of the participants got tired, stressed out, got bored, and felt angry due to the technical problems that they encountered. Examples of views reflecting teachers' answers are as below:

T-8: "I experienced problems with the internet connection. When students experience connectivity problems, you cannot teach the lesson, you stress out, and you cannot make progress on the topic, or Zoom (software) log you out of the course, you try to log in. These challenges stressed me out."

T-18:"Even if I live in the city center, we always have internet problems. Internet connection is lost. Zoom constantly logs students out. When students logged in again, they had already missed the topic. Repeating the topic for students missing the topic due to the technical problem caused people to feel too tired and bored after a while.".

T-19: "We are faced with technical problems almost in every lesson. Either the internet connection is unavailable or there is a problem with the connection. I have six hours of course per day. Individually, I need to create each lesson online. When we create the lesson online, we experience connection problems. Sometimes, I had to wait for minutes so that the web page of the Educational Informatics Network of Turkey

(EBA) could be refreshed. Sometimes, I got bored with waiting. Believe me, sometimes, I fell asleep while waiting and forgot to create the lesson for the course. As soon as I wake up in the morning, I hastily create the lesson. This sort of disorganization made me highly tired. I do not go to school, I am always at home, but I get more tired in comparison to the past.".

Upon the review of the second category, ***attitude toward the course***, it is identified that 40% of the participants said that they had motivation deficiency due to technical problems. Examples of views reflecting teachers' answers are as below:

T-10: "We experienced technical problems. In the village, there is an internet problem. The students could not participate actively in the lesson. Lecturing a lesson solely to one student, rather than 30 students as in normal circumstances, wore us down both motivationally and psychologically. This affected all our organizational patterns. I have a course curriculum to teach. There is a mass of students to whom you need to lecture. However, you cannot reach them. This situation, in turn, makes us feel uneasy alongside the following questions: 'How will I cover the topics in due time, how can I reach the student?".

Also, 35% of the teachers put forward that their willingness to teach lessons decreased due to experiencing technical problems.

T-20:"In the 30-minute lecture, constantly, there were technical problems, and this situation induced me to be an aggressive person. Due to the problems that I encountered, my willingness and eagerness to teach a lesson in distance education decreased.".

Besides these problems, 20% of the teachers asserted that they had anxiety about covering course topics in due time.

T-10: "The students could not participate actively in the lesson. Lecturing a lesson solely to one student, rather than 30 students as in normal circumstances, wore us down both motivationally and psychologically. This affected all our organizational patterns. I have a course curriculum to teach. There is a mass of students to whom you need to lecture. However, you cannot reach them. This situation, in turn, makes us feel uneasy alongside the following questions: 'How will I cover the topics in due time, how can I reach the student?".

Problems That the Change in the Way of Working Created in Daily Life

Problems that the change in the way of working created in daily life were presented in Table 5.

Table 5

Problems That the Change in the Way of Working Produce in Daily Life

Theme	Category	Code	Frequency
Change in the way of working	Work-related circumstances	Increase in the workload	15
		Difficulty in focusing on the work	2
		Decrease in work tempo	2
		Health problems	1
	Personal circumstances	Obligation to communicate with student's legal guardian/parents	4
		Disturbance of life order	12
		Decrease in the time allocated to family and daily life	8
		Increase in technology use	6

As viewed in Table 5, two categories were created based on teachers' views about problems that the change in the way of working produced in daily life. These categories were, firstly, work-related circumstances, and secondly, personal circumstances. In this context, the codes of "increase in the workload", "difficulty in focusing on the work", "decrease in work tempo", and "health problems" formed the category of work-related circumstances. Next, the codes of "obligation to communicate with student's legal guardian/parents", "disturbance of life order", "decrease in the time allocated to family and daily life", and "increase in technology use" constituted the category of personal circumstances.

Upon the review of the first category, ***work-related circumstances***, it is discerned that 75% of the participants told that lecturing lessons in distance education increased their workload whilst only 2 teachers said that their work tempo slowed down, and also 2 teachers stated that they had difficulty in focusing on the work. Besides, it was discerned that one of the teachers had back and low back pains and eye pains due to using the computer constantly in the distance education process. Examples of views reflecting teachers' answers are as below:

T-16: "Our job did not get comfortable in comparison to the past because the task of creating the lesson online fell upon us. First, you create the lesson and then launch it. This is a burden. As we lectured with the distance education method, we were obliged to look through and find more images. This was also a burden on us."

T-17: "In distance education, the process of getting prepared for the lesson took us longer. We experienced problems such as arranging the technological devices, setting up the platform, and also, transferring the resources to students. We spent long hours on distance education. As we could not know exactly whether the students understood the topic or not, we sensitively addressed certain topics twice or three times. This became more tiring for us."

T-1: "In face-to-face education, there was an order. The time schedule for coming to school and leaving it was the same for everyone. However, in distance education, you have to teach the lesson in the period convenient to students due to some students' time conflicts with the time schedules of their brothers and sisters. You are obliged to arrange your time schedule according to them. Unavoidably, this, in turn, was affecting my daily routine. Most of the time, I was starting to lecture the lesson in the morning, and my lecture was continuing until evening. This, in return, was affecting my social life. It takes me very long to prepare, add, and create lessons online. This increased my workload."

T-7: "Mostly, it had negative impacts. The topics could not be covered in due time. Away from school, at home, we had to prepare the documents that we did not use to prepare at the school. Our workload increased. Initially, as I did not know what to do in the lesson preparation process, I had hardships."

T-9: "…In face-to-face education, we did not use to have any connection with the school after we left the school. On the other hand, in the distance education process, controlling students' homework assignments and communicating frequently with students' legal guardians/parents increased our workload and affected our daily lives considerably."

T-16: "Firstly, the routine works were interrupted. Additionally, the impossibility to get out of home was a problem. Lecturing a lesson and looking at a computer by constantly sitting down created physical problems such as eye pain, low back pain, and back pain."

In the context of the examination of the second category, ***personal circumstances***, it is identified that 60% of the participants said that lecturing lessons by using the distance education method disturbed their order. Also, it was discerned that the change in the way of working created the obligation for teachers to communicate with students' legal guardians/parents. Besides, 40% of the teachers told that the time allocated to family and daily life decreased. Moreover, 30% of the teachers stated that they used technology more frequently in this process. Examples of teachers' views are as below:

T-20: "The process of preparing the lesson was considerably prolonged for us in distance education. Firstly, we create the lesson through Zoom and EBA and then inform students' legal guardians/parents. This is really a time-consuming process. Controlling homework assignments with a phone also takes longer."

T-5: "In the past, we used to come to school in the morning and we used to have the afternoon for us. We could spare some time for ourselves. We could spend time with our families. We could find different alternatives. In distance education, we have a lesson in the morning on a day and we have another lesson in the afternoon on the next day. Therefore, distance education changed our entire life. In distance education, a heavier workload was placed on us. The process of preparation for the lesson takes a long time. You prepare the topics. You think about how you will teach the lesson to the student through EBA and make efforts about it. We made more preparations. So, more workload was on us."

T-9: "We started to spend time mostly with the phone. The phone began to be a focal point of our lives."

T-10: "It changed our life order totally. We had to move the work to home. The order at home, our lives, plans, and programs changed completely. Our workload increased even further. In the past, it used to go on in a more planned, programmed, and routine manner. In the new system, the student does not attend the course, and you have to repeat the lesson. We had a more disordered life. In comparison to the past, getting prepared for the lesson is harder because you will create the lesson online and inform the student. It has a more challenging aspect."

T-13: "Our course hours, work hours, and our order suddenly changed. The work never ended. Our work setting was moved to our home. When we left school for home, the work used to stay at the school. However, in distance education, this is not the case. Our work lives occupied the seat of honor in our home. We had trouble allocating time to our family. We had difficulty focusing on our work. Moving the school to our home did not have quite good consequences."

Teachers' Relations with School Administration and Co-Workers in the Period of the Pandemic

Teachers' relations with school administration and co-workers in the period of the pandemic are displayed in Table 6.

Table 6

Participants' Relations with School Administration and Co-Workers in the Period of the Pandemic

Theme	Category	Code	Frequency
Relations with school administration and co-workers	Communication	Having a lack of communication	11
		Being obliged to meet in the virtual platform	7
		Having difficulty in solving problems	3
		Not having so close relations as in the past	6
		Being unable to find the person to consult with	6
		Being obliged to work alone	7
		Being misunderstood	2
		Having no communication problem	2

As viewed in Table 6, all teachers' views about their relations with school administration and co-workers in the period of the pandemic were addressed under the category of ***communication***. The codes of "having a lack of communication", "being obliged to meet in the virtual platform", "having difficulty in solving problems",

"not having so close relations as in the past", "being unable to find the person to consult with", "being obliged to work alone", "being misunderstood", and "having no communication problem" constituted the category of communication. Upon the review of these codes, it is discerned that 55% of the participants had a lack of communication with the school administration and co-workers. Also, a non-negligible number of teachers stated that the relations were not so close as in the past. Moreover, a part of the teachers mentioned problems created by the obligation to meet in the virtual platform. Additionally, 30% of the teachers stated that they were obliged to work alone and were unable to find the person to consult with. Besides these problems, 2 teachers said that they did not have a communication problem. Examples of teachers' views are as below:

T-9: "Under normal conditions, we used to come to school every day and communicate with each other about students. However, as we could not see each other in the distance education process, we had a lack of communication. This affected our interdisciplinary relationship."

T-14: "We suffered from the lack of communication with our co-workers since we were not so close any longer. In the period of the pandemic, it is never the same as it used to be when the school was open. In the past, communicating used to be easier, now it is more difficult. As communication gets more difficult, certain setbacks can emerge."

T-15: "In the period of the pandemic, our relations with our co-workers unavoidably began to get a little colder because the opportunity to have face-to-face meetings was limited. Our work did not go along as in the past. Always something was missing."

T-2: "In face-to-face education, reaching our administrators and co-workers was easier. We had closer relations. As everyone was at home in distance education, we were disconnected. This, in return, had negative effects on the way I did my work."

T-6: "We cannot say that it got better. In this period, people can experience psychological problems. People turn in on themselves. We become stress-oriented. We experience communication failures. When there is a problem, we can solve it easily face-to-face whereas solving the problem gets harder from a distance.

T-1: "We had good relations with the school administration but we were not very connected with our co-workers. We were at home and we did not have the opportunity to meet. When we were at school, on the basis of the problems, we were exchanging views at least with my teacher group about which technical method to use. However, after distance education was put in place, unavoidably, there was a lack of communication.

The Effect of Teleworking System on the Work-Life Balance in the Period of the Pandemic

The effect of teleworking system on the work-life balance in the period of the pandemic are displayed in Table 7.

Table 7

The Effect of Teleworking System on Work-Life Balance

Theme	Category	Code	Frequency
Effect of teleworking on work-life balance	Work-related problems	Difficulty in focusing on the work	4
		Inability to create a classroom setting	5
	Family-related problems	Family members' demands as obstacles to working	5
		Fall in the time allocated to the family	13
	Experiencing no problem	Living alone	3

As viewed in Table 7, participants' views about the effect of teleworking system on work-life balance in the period of the pandemic were grouped under two categories. These categories were, firstly, work-related problems, secondly, family-related problems, and thirdly, having no problem. The category of work-related problems was comprised of the codes of "difficulty in focusing on the work" and "inability to create a classroom setting". Next, the codes of "family members' demands as obstacles to working" and "fall in the time allocated to the family" formed the category of family-related problems. Lastly, the category of experiencing no problem was composed of the code of "living alone".

Alongside the examination of the first category, ***work-related problems***, it is discerned that teachers had difficulty in focusing on the work and creating a classroom setting in the teleworking system. Upon the review of the second category, ***family-related problems***, it is identified that 65% of the teachers could not allocate a long time to their families in the teleworking system. Besides, 25% of the teachers stated that their families' demands prevented them from teleworking. As per the analysis of the third category, ***experiencing no problem***, it is found that only three teachers said that there was no change in their lives as they lived alone but the teleworking system could disturb the work-life balance in the case of teachers living with their families. Examples of teachers' views are as below:

T-17: "The live lectures can start at 10:00 am and continue until 7:00-8:00 pm. Providing live courses at home affected particularly the lives of married couples, they could not allocate enough time to each other. My spouse is a teacher, and she also had live lectures. As the work hours lasted from 10:00 am to 8:00 pm, we arranged our lives in line with this situation. Everyone arranged his/her breakfast, dinner, and responsibilities taking the live lectures into consideration. In this process, I had difficulty finding enough time. My spouse and I could not allocate a long time to each other. After all, when I did not have a live lecture, I reserved my time for my personal rest."

T-16: "We had imbalances and certain challenges as each household had its own particular order in the family setting, and as there was no classroom setting. As we could not provide a classroom setting. You cannot stop the ongoing home life just to teach a lesson."

T-10: "It affected negatively. In the previous order, when we came to school, focusing on work by leaving our home life aside completely was easier. We could devote ourselves to the work %100. As home life and professional life are combined at the moment and as I am a woman, I am obliged to do housework in breaks. Or, if there is a problem at home, of course, I need to deal with it in the break. Therefore, it had a negative effect. It decreased my motivation."

T-13: "It was hard. It was hard to allocate time from work to family. It was hard to allocate time from family to work. In the middle of the house, in the middle of the sitting room, we had both our family and work. Keeping the two in balance was hard."

T-14: "As I have a spouse and two children, in any case, they demand something when I lecture a lesson at home. Therefore, I cannot get adapted. I was inhibited from doing my work."

T-6: "As I live alone, I have no problem. However, those living with their families can experience problems."

Negative Effects of Teleworking System on Health in the Period of the Pandemic

Negative effects of teleworking system on health in the period of the pandemic are displayed in Table 8.

Table 8

Negative Effects of Teleworking System on Health

Theme	Category	Code	Frequency
Negative effects of teleworking on health	Health problems	Eye problems	10
		Muscle and joint problems	8
		Headache	7
		Stomach problems	1
		Psychological problems	1
		Insomnia	5
		Increase in cigarette smoking	2
		Distortion in the dietary pattern and gaining weight	3

As viewed in Table 8, all teachers' views about the negative effects of the teleworking system on health were grouped under the category of ***health problems***. The category of health problems was comprised of the codes of "eye problems", "muscle and joint problems", "headache", "stomach problems", "psychological problems", "insomnia", "increase in cigarette smoking", and "distortion in the dietary pattern and gaining weight". Upon the review of these codes, it is discerned that 50% of the participants had eye problems in the teleworking system, 40% of them had muscle and joint problems, and 35% of them had headaches. Besides, 25% of the teachers said that they had irregular sleep patterns due to the irregularities in course hours. Additionally, 2 teachers told that they smoked cigarettes more frequently in this period, and 3 teachers said that they constantly wanted to eat because of staying at home, and thus, they gained weight. Examples of teachers' views are as below:

T-1: "As I was always at home, I was eating some foodstuff during breaks. In this process, I gained too much weight.

T-7: "Due to looking at the screen, I had headaches. As we are constantly seated in the same position, I also had muscle pains."

T-13: "Because of being seated in front of the computer, I had low back pain."

T-15: "I am a cigarette smoker. It is not all right to say that, but I started to smoke a lot. I began to be more addicted to smoking. Of course, I also began to have a variety of health problems associated with smoking."

T-18: "I already had eye problems. In this period, my eye problems aggravated. Due to having a herniated disc, I had a surgical operation. So, due to constantly being seated, my pains increased. During breaks, I sometimes have to do exercise."

Conclusion and Discussion

This study aimed to identify the psycho-social hazards encountered by teachers who took active roles in the distance education process in the period of the pandemic. The changes in both instruction processes and ways of working in the period of the pandemic can induce teachers to give psychological reactions to the work.

In this study, the majority of participants found that the COVID-19 measures taken at workplaces were adequate, however, they stated that they felt uneasy due to problems stemming from students (mask use, social

distancing, and hygiene). Even though hygiene conditions satisfied the needs at the school, the teachers felt uneasy as the students did not abide by the rules about mask use and social distancing.

Moreover, in the current study, it was discerned that the teachers who experienced technical problems in the period of the pandemic were exposed to emotional effects such as getting tired, having stress, getting bored, and feeling angry. These emotional effects came into play due to reasons such as internet connection problems experienced in the instruction process, the lack of student participation in the class, and anxiety felt about covering the topics in the curriculum in due time. In parallel to the current study, the study by İnce, Şahin, and Yentür (2021) stated that the lack of student participation in the class and internet connection problems were the reasons preventing teachers from lecturing the lessons efficiently. In the studies in the relevant literature, it was put forward that, according to teachers' views, some of the disadvantages of distance education were the inadequacy of infrastructure and technological facilities (Paydar & Doğan, 2019; Bakioğlu & Çevik, 2020; Başaran, Doğan, Karaoğlu & Şahin, 2020; Demir & Özdaş, 2020; Avcı & Akdeniz, 2021), difficulty in having access to technological devices and internet (Baek, Jones, Bulger, & Taliaferro, 2018; Fidan, 2020), and the inability to get technical support (Muilenburg & Berge, 2005; DePaepe, Zhu, & DePryck, 2018). Besides, in the study by Casacchia et al. (2021), it was asserted that the biggest problem encountered by educators in distance education during the COVID-19 pandemic was the internet connection problem. Next, in the current study, the teachers said that, due to technical problems, they felt worried about covering the topics in the curriculum in due time in the distance education process. In a similar vein to the current study, previous studies indicated that the educators were worried about covering the topic in the curriculum in due time as they were under pressure to provide online instruction, the work setting was not suitable, the student participation in classes was inadequate, and the time was insufficient (Dempsey & Burke, 2020; Bakioğlu & Çevik, 2020; TEDMEM, 2020; Can, 2020).

Furthermore, in the current study, upon reviewing whether the change in the ways of working affected participants' daily lives, it was identified that the teachers were confronted with psycho-social hazards related to work and personal circumstances. Teachers told that their workload increased along with the change in the ways of working during the compulsory distance education process. It can be asserted that, along with increasing workload, the teachers had difficulty in focusing on work, and their work order was disturbed in comparison to the period of formal education. Together with these changes, the time allocated by teachers to the family decreased because the teachers were obliged to make extra efforts to both manage the distance education process and continue their social lives. Teachers who had to work at home had difficulty in meeting family members' needs fully (Casacchia et al., 2021). Likewise, in the study by Metin, Gürbey, and Çevik (2021), it was stated that the teachers got more tired and had a heavier workload in the distance education process than they did in face-to-face education.

Besides, in the current study, it was discerned that the teachers had difficulty in enabling the entire class of students to focus on the lesson and had trouble in creating a classroom setting in the compulsory distance education process. The study by Fidan (2020) stated that the teachers expressed negative views about the management of the classroom due to the difficulty of enabling the entire class of students to focus on the lesson in the compulsory distance education process. The study by Iwai (2020) indicated that a large number of educators could not teach lessons due to the challenges of managing a classroom by using a screen and microphone. Next, in the current study, teachers asserted that they had a lack of communication with administrators and co-workers during the period of the pandemic. As a consequence of the decrease in interaction in the teleworking process, the teachers could not find the person to consult with to solve problems, and most of the time, they were obliged to work alone. In a similar study, it was put forward that teachers' and students' interactions with their peers decreased in the distance education process (Metin et al., 2021). Likewise, in the study performed by Çakın and Akyavuz (2020) to identify school administrators' views about the effect of the pandemic on education, it was found that the school administrators had problems due to the lack of communication with teachers.

Also, in the current study, the participants put forward that the negative effects of teleworking system on health were eye problems, muscle and joint problems, and headache. In a similar study, it was stated that the musculoskeletal pains, stress, emotional exhaustion, desensitization, and burnout perception increased due to limited physical activities in the period of the pandemic (Kutlutürk & Yıkılmaz, 2021). Besides these effects, it is discerned that the teachers experienced sleep problems. In the study conducted by Casacchia et al. (2021) to analyze how the teaching staff coped technically and emotionally with the challenge of adapting to a new instruction method in the quarantine period in Italy, it was stated that, at varying degrees, the teachers had emotional problems such as depressive symptoms, sleep problems, loss of energy, and difficulty in concentrating.

Additionally, in the current study, the disturbance of work-life balance due to the increase in workload in distance education in comparison to formal education induces teachers to have stress. In studies performed about the work-life balance, it is stated that the disturbance of this balance had a negative effect on mental health in employees (Phillips, Sen, & McNamee, 2007; Shimazu & Bakker, 2009; Sanz Vergel, 2011; Pu, Hou, Ma, & Sang, 2017; Neto, Chambel, & Carvalho, 2018; Silva & Fischer, 2020; Oakman et al., 2020; Wang, Ma, & Guo, 2020). Furthermore, it was asserted that the excessive workload to which the employees were exposed in the period of the pandemic caused stress by affecting the work-life balance negatively (Ozamiz-Etxebarria, Santamaría, Mondragon, & Santxo, 2021; Lizana & Vega-Fernadez, 2021). The heavy workload and stress highlighted in the pre-pandemic period in studies performed on teachers (Blix, 1994; Delcor et al., 2004; Shernoff et al., 2011) increased further and affected the quality of teachers' lives negatively in the period of the pandemic. Besides, in the studies in the relevant literature, it was put forward that the workload increasing in the period of the pandemic affected the work-life balance more in female teachers and caused female teachers to have extreme stress (Klapproth, Federkeil, Heinschke, & Jungmann, 2020; Silva & Fischer, 2020; Lizana & Vega-Fernadez, 2021; Kara, Günes, & Tüysüzer, 2021). It can be said that this situation is associated with the fact that female employees have more roles and responsibilities in the family (Lizana & Vega-Fernadez, 2021). In another study, it was identified that the employees' unpreparedness for teleworking system influenced the work performance, the prolongation of the work period affected the workplace discipline, and having meetings at homes of families with children was difficult and the workload increased (Akbaş Tuna & Türkmendağ, 2021).

In conclusion, it is discerned that the teachers who were obliged to telework in the period of the pandemic were confronted with numerous psycho-social hazards such as adapting to a new instruction method, preparing lessons at home without receiving any technical support, not being in communication with administrators and co-workers, having anxiety about covering the topics in the curriculum in due time. The need to get both technical and psychological support arose for teachers to cope with these hazards. As the increasing workload on teachers affected the work-life balance negatively in the period of the pandemic, the technical training to be offered to teachers should be planned to ensure that the workload will be reduced. Also, by identifying the psycho-social problems experienced by teachers in the period of the pandemic, support services should be provided to teachers based on their needs.

References

Akbaş Tuna, A. & Türkmendağ, Z. (2021). Covid-19 pandemi döneminde uzaktan çalışma uygulamaları ve çalışma motivasyonunu etkileyen faktörler. *İşletme Araştırmaları Dergisi, 12*(3), 3246–3260.

Allen, R., Jerrim, J. & Sims, S. (2020). How did the early stages of the COVID-19 pandemic affect teacher wellbeing? (CEPEO Working Paper No. 20-15). Centre for Education Policy and Equalising Opportunities. Accessed from https://EconPapers.repec.org/RePEc:ucl:cepeow:20-15.

Avcı, F. & Akdeniz, E. C. (2021). Koronavirüs (Covid-19) salgını ve uzaktan eğitim sürecinde karşılaşılan sorunlar konusunda öğretmenlerin değerlendirmeleri. *Uluslararası Sosyal Bilimler ve Eğitim Dergisi*, *3*(4), 117-154.

Baek, J. H., Jones, E., Bulger, S. & Taliaferro, A. (2018). Physical education teacher perceptions of technology-related learning experiences: A qualitative investigation. *Journal of Teaching in Physical Education, 37*(2), 175-185. https://doi.org/10.1123/jtpe.2017-0180

Bakan Selçuk, Koronavirüs'e Karşı Eğitim Alanında Alınan Tedbirleri Açıkladı. (2020). Milli Eğitim Bakanlığı. Retrieved from http://www.meb.gov.tr/bakan-selcuk-koronaviruse-karsi-egitim-alaninda-alinan-tedbirleri-acikladi/haber/20497/tr

Bakioğlu, B. & Çevik, M. (2020). COVID-19 pandemisi sürecinde fen bilimleri öğretmenlerinin uzaktan eğitime ilişkin görüşleri. *Turkish Studies, 15*(4), 109-129. https://dx.doi.org/10.7827/TurkishStudies.43502

Başaran, M., Doğan, E., Karaoğlu, E. & Şahin, E. (2020). Koronavirüs (Covıd-19) pandemi sürecinin getirisi olan uzaktan eğitimin etkililiği üzerine bir çalışma. *Academia Eğitim Araştırmaları Dergisi*, *5*(2), 368-397.

Blix, A. G., Cruise, R. J., Mitchell, B. M. & Blix, G. G. (1994). Occupational stress among university teachers. *Educational research*, *36*(2), 157-169. https://doi.org/10.1080/0013188940360205

Can, E. (2020). Coronavirüs (Covid-19) pandemisi ve pedagojik yansımaları: Türkiye'de açık ve uzaktan eğitim uygulamaları. *AUAd, 6*(2),11-5.

Carayon P., Yang C. & Lim, S. (1995). Examining the relationship between job design and worker strain over time in a sample of office workers. *Ergonomics, 38*, 1199–211. https://doi.org/10.1080/00140139508925182

Casacchia, M., Cifone, M. G., Giusti, L., Fabiani, L., Gatto, R., Lancia, L., Cinque, M., Petrucci, C., Giannoni, M., Ippoliti, R., Frattaroli, A. R., Macchiarelli, G., & Roncone, R. (2021). Distance education during COVID 19: An Italian survey on the university teachers' perspectives and their emotional conditions. *BMC Medical Education, 21*(1), 1-17. https://doi.org/10.1186/s12909-021-02780-y

Cavanaugh, C.S. (2001). The effectiveness of interactive distance education technologies in K-12 Learning: A meta-analysis. *International Journal of Educational Telecommunications, 7*(1), 73-88.

Chang, G. C. & Yano, S. (2020). How are countries addressing the Covid-19 challenges in education? A snapshot of policy measures. *World Educ. blog*. Retrieved from https://gecv.ac.in/uploads/ssip/UNESCO%20snap%20shot%20for%20maintaining%20education.pdf

Çakın, M. & Külekçi Akyavuz, E. (2020). Covid-19 süreci ve eğitime yansıması: öğretmen görüşlerinin incelenmesi. *International Journal of Social Sciences and Education Research*, *6* (2), 165-186 . DOI: 10.24289/ijsser.747901

De Paepe, L., Zhu, C. & DePryck, K. (2018). Drop-out, retention, satisfaction and attainment of online learners of Dutch in adult education. *International Journal on E-Learning*, *17*(3), 303-323.

Delcor, N. S., Araújo, T. M., Reis, E. J., Porto, L. A., Carvalho, F. M., Barbalho, L. & de Andrade, J. M. (2004). Labor and health conditions of private school teachers in Vitória da Conquista, Bahia, Brazil. *Cadernos de saude publica*, *20*(1), 187-196. DOI: 10.1590/s0102-311x2004000100035

Demir, F. & Özdaş, F. (2020). Covid-19 sürecindeki uzaktan eğitime ilişkin öğretmen görüşlerinin incelenmesi. *Milli Eğitim Dergisi*, *49*(1), 273-292. DOI: 10.37669/milliegitim.775620

Demiray, U. (1999). Bir çağdaş eğitim modeli olarak uzaktan eğitim uygulaması. *Jandarma Dergisi, 85*, 46-52.

Dempsey, M. & Burke, J. (2020). *Covid-19 practice in primary schools in Ireland report*. Maynoot University. Retrieved from http://mural.maynoothuniversity.ie/13001/

Ekiz, D. (2009). *Bilimsel araştırma yöntemleri* (2. Edition). Anı Yayıncılık.

Elitaş, T. (2017). Uzaktan eğitim lisans sürecinde yeni iletişim teknolojileri: Atatürk Üniversitesi uzaktan eğitim merkezi (Unpublished PhD Thesis). Marmara University, Istanbul.

Eşici, H., Ayaz, A., Yetim, D., Çağlar, S., & Bedir, N. (2021). Teachers in COVID-19 period: Psychological effects, practices and career needs. *Turkish Journal of Education, 10*(2), 157-177. https://doi.org/10.19128/turje.855185

Ferrie, J. E., Shipley, M. J., Marmot, M. G., Stansfeld, S. A. & Smith, G. D. (1998). An uncertain future: The health effects of threats to employment security in white-collar men and women. *American Journal of Public Health*, *88*(7), 1030-1036. https://doi.org/10.2105/AJPH.88.7.1030

Fidan, M. (2020). Covid-19 belirsizliğinde eğitim: İlkokulda zorunlu uzaktan eğitime ilişkin öğretmen görüşleri. *Uşak Üniversitesi Eğitim Araştırmaları Dergisi*, *6*(2), 24-43. DOI: 10.29065/usakead.736643

Frone, M. R., Russell, M. & Cooper, M. L. (1995). Job stressors, job involvement and employee health: A test of identity theory. *Journal of Occupational and Organizational Psychology, 68*(1), 1-11.https://doi.org/10.1111/j.2044-8325.1995.tb00684.x

Giovannella, C., Passarelli, M. & Persico, D. (2020). The effects of the Covid-19 pandemic on Italian learning ecosystems: The school teachers' perspective at the steady state. *ID&A Interaction Design & Architecture(s), 45*, 264-286.

Green, F. & McIntosh, S. (2001). The intensification of work in Europe. *Labour Economics*, *8*(2), 291-308. https://doi.org/10.1016/S0927-5371(01)00027-6

Iwai, Y. (2020). Online learning during the COVID-19 pandemic what do we gain and what do we lose when classrooms go virtual. *Scientific American*, 13. Retrieved from https://blogs.scientificamerican.com/observations/online-learning-during-the-COVID-19-pandemic/

İnce, Z., Şahin, V. & Yentür, M. (2021). Coğrafya öğretmenlerinin Covid-19 sürecinde uzaktan eğitim Yöntemiyle coğrafya öğretimi hakkındaki görüşleri: İstanbul örneği. *Sosyal, Beşeri ve İdari Bilimler Dergisi*, *4*(8), 707-729. https://doi.org/10.26677/TR1010.2021.794

Kara, S. B. K., Günes, D. Z. & Tüysüzer, B. S. (2021). Work-Family conflict during working from home due to pandemic: A qualitative research on female teachers. *International Journal of Curriculum and Instruction*, *13*(1), 251-273.

Klapproth, F., Federkeil, L., Heinschke, F. & Jungmann, T. (2020). Teachers' experiences of stress and their coping strategies during COVID-19 induced distance teaching. *Journal of Pedagogical Research, 4*(4), 444-452. https://doi.org/10.33902/JPR.2020062805

Košir, K., Dugonik, Š., Huskić, A., Gračner, J., Kokol, Z. & Krajnc, Ž. (2020). Predictors of perceived teachers' and school counsellors' work stress in the transition period of online education in schools during the COVID-19 pandemic. *Educational Studies,* 1-5. https://doi.org/10.1080/03055698.2020.1833840

Kutlutürk, S. & Yıkılmaz, İ. (2021). Covid-19 pandemisi uzaktan çalışma sürecinde akademisyenlerin iş stresi, tükenmişlik algısı ve kas iskelet sistemi ağrılarının incelenmesi. *Hacettepe University Faculty of Health Sciences Journal*, *8*(2), 297-313.

Ladipo, D., Mankelow, R. & Burchell, B. (2005). Working like a dog, sick as a dog: Job intensification in the late twentieth century. In *Systems of Production* (pp. 103-117). Routledge.

Leung, M. Y., Liang, Q. & Olomolaiye, P. (2016). Impact of job stressors and stress on the safety behavior and accidents of construction workers. *Journal of Management in Engineering*, *32*(1). https://doi.org/10.1061/(ASCE)ME.1943-5479.0000373

Lincoln, Y. S. & Guba, E.G. (1985). *Naturalistic inquiry.* Sage Publications.

Lizana, P. A., Vega-Fernadez, G., Gomez-Bruton, A., Leyton, B. & Lera, L. (2021). Impact of the COVID-19 pandemic on teacher quality of life: A longitudinal study from before and during the health crisis. *International Journal of Environmental Research and Public Health, 18*(7), 3764. https://doi.org/10.3390/ijerph18073764

Marshall, C. & Rossman, G. B. (2014). *Designing qualitative research*. Sage publications.

Marshall, G. W., Michaels, C. E. & Mulki, J. P. (2007). Workplace isolation: Exploring the construct and its measurement. *Psychology & Marketing, 24*(3), 195-223. https://doi.org/10.1002/mar.20158

McMillan, J. H. & Schumacher, S. (2010). *Research in education evidence-based inquiry* (7. edition). Pearson Education Inc.

Merriam, S.B. (1998). *Qualitative research and case study applications in education* (2. edition). Jossey-Bass Publishers.

Metin, M., Gürbey, S. & Çevik, A. (2021). Covid-19 pandemi sürecinde uzaktan eğitime yönelik öğretmen görüşleri. *Maarif Mektepleri Uluslararası Eğitim Bilimleri Dergisi, 5*(1), 66-89. https://doi.org/10.46762/mamulebd.881284

Miles, M. B. & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. Sage.

Muilenburg, L. Y. & Berge, Z. L. (2005). Student barriers to online learning: A factor analytic study. *Distance Education, 26*(1), 29-48. https://doi.org/10.1080/01587910500081269

Neto, M., Chambel, M. J. & Carvalho, V.S. (2018). Work-family life conflict and mental well-being. *Occupational Medicine*, *68*(6), 364-369. doi: 10.1093/occmed/kqy079.

Oakman, J., Kinsman, N., Stuckey, R., Graham, M. & Weale, V. (2020). A rapid review of mental and physical health effects of working at home: How do we optimise health?. *BMC Public Health, 20*(1), 1-13.59. https://doi.org/10.1186/s12889-020-09875-z

Ozamiz-Etxebarria, N., Santamaría, M.D., Mondragon, N.I. & Santxo, N.B. (2021). Emotional state of school and university teachers in northern Spain in the face of COVID-19. *Revista Española de Salud Pública*. 95.

Papadopoulos, G., Georgiadou, P., Papazoglou, C. & Michaliou, K. (2010). Occupational and public health and safety in a changing work environment: An integrated approach for risk assessment and prevention. *Safety Science*, *48*(8), 943-949. https://doi.org/10.1016/j.ssci.2009.11.002

Paydar, S. & Doğan, A. (2019). Öğretmen adaylarının açık ve uzaktan öğrenme ortamlarına yönelik görüşleri. *Eğitim ve Teknoloji, 1* (2), 154-162.

Phillips, S., Sen, D. & McNamee, R. (2007). Prevalence and causes of self-reported work-related stress in head teachers. *Occupational Medicine*, *57*(5), 367-376. https://doi.org/10.1093/occmed/kqm055

Pu, J., Hou, H., Ma, R. & Sang, J. (2017). The effect of psychological capital between work–family conflict and job burnout in Chinese university teachers: Testing for mediation and moderation. *Journal of Health Psychology*, *22*(14), 1799-1807. https://doi.org/10.1177/1359105316636950

Purwanto, A., Asbari, M., Fahlevi, M., Mufid, A., Agistiawati, E., Cahyono, Y. & Suryani, P. (2020). Impact of work from home (wfh) on Indonesian teachers performance during the Covid-19 pandemic: An exploratory study. *International Journal of Advanced Science and Technology*, *29*(5), 6235-6244.

Rubin, O., Nikolaeva, A., Nello-Deakin, S. & te Brömmelstroet, M. (2020). What can we learn from the COVID-19 pandemic about how people experience working from home and commuting. *Centre for Urban Studies, University of Amsterdam*, 1-9. Retrieved from https://urbanstudies.uva.nl/content/blog-series/covid-19-pandemic-working-from-home-and-commuting.html

Sanz Vergel, A. I. (2011). Conciliación y salud laboral:¿ una relación posible?: Actualidad en el estudio del conflicto trabajo-familia y la recuperación del estrés. *Medicina y seguridad del trabajo*, 57, 115-126. https://dx.doi.org/10.4321/S0465-546X2011000500008

Shernoff, E. S., Mehta, T. G., Atkins, M. S., Torf, R. & Spencer, J. (2011). A qualitative study of the sources and impact of stress among urban teachers. *School Mental Health, 3*(2), 59-69. https://doi.org/10.1007/s12310-011-9051-z

Shimazu, A., Bakker, A. B. & Demerouti, E. (2009). How job demands affect an intimate partner: A test of the spillover-crossover model in Japan. *Journal of Occupational Health*, *51*(3) 239. https://doi.org/10.1539/joh.L8160

Silva, J. P. D. & Fischer, F. M. (2020). Understudied school teachers' work/life balance and everyday life typologies. *Chronobiology International*, *37*(9-10), 1513-1515. https://doi.org/10.1080/07420528.2020.1808010

Sindiani, A.M., Obeidat, N., Alshdaifat, E., Elsalem, L., Alwani, M., Rawashdeh, H., Fares, A., Alalawne, T. & Tawalbeh, L. İ. (2020). Distance education during the COVID-19 outbreak: A cross-sectional study among medical students in North of Jordan. *Annals of Medicine and Surgery,* 59, 186–194. doi: https://doi.org/10.1016/j.amsu.2020.09.036

Stake, R.E. (2003). Case studies. In N. K. Denzin & Y. Lincoln (Eds), *Strategies of Qualitative Inquiry* (2nd edition), (pp. 134-164). Sage.

Stansfeld, S. A., Fuhrer, R., Shipley, M. J. & Marmot, M. G. (1999). Work characteristics predict psychiatric disorder: Prospective results from the Whitehall II Study. *Occupational and Environmental Medicine*, *56*(5), 302-307. http://dx.doi.org/10.1136/oem.56.5.302

Tarafdar, M., Tu, Q., Ragu-Nathan, B. S. & Ragu-Nathan, T. S. (2007). The impact of technostress on role stress and productivity. *Journal of Management Information Systems*, *24*(1), 301-328. https://doi.org/10.2753/MIS0742-1222240109

TEDMEM (2020). *Teachers in the COVID-19 outbreak process.* Retrieved from https:// tedmem.org/covid-19/covid-19-salgini-surecinde-ogretmenler

Trust, T. & Whalen, J. (2020). Should teachers be trained in emergency remote teaching? Lessons learned from the COVID-19 pandemic. *Journal of Technology and Teacher Education*, *28*, 189–199.

Truzoli, R., Pirola, V. & Conte, S. (2021). The impact of risk and protective factors on online teaching experience in high school Italian teachers during the COVID-19 pandemic. *Journal of Computer Assisted Learning*, 1-13. https://doi.org/10.1111/jcal.12533

Türen, U., Erdem, H. & Kalkın, G. (2015). İş yerinde tekno-stres ölçeği: Havacılık ve bankacılık sektöründe bir araştırma. *Çalışma İlişkileri Dergisi*, *6*(1), 1-19.

Vatansever, Ç. (2014). Risk değerlendirmede yeni bir boyut, psikososyal tehlike ve riskler. *Çalışma ve Toplum Dergisi,* 117-138.

Wang, H. M., Ma, A. L. & Guo, T. T. (2020). Gender concept, work pressure, and work–family conflict. *American Journal of Men's Health*, *14*(5), 1-12. https://doi.org/10.1177/1557988320957522

World Health Organization. (2008). *PRIMA-EF: Guidance on the European framework for psychosocial risk management: A resource for employer and worker representatives*. Retrieved from https://www.who.int/occupational_health/publications/PRIMA-EF%20Guidance_9.pdf

Yıldırım, A. & Şimşek, H. (2011). *Sosyal bilimlerde nitel araştırma yöntemleri*. (8. Edition). Seçkin Yayıncılık

Yurdakul, B. (2015). Uzaktan eğitim. In Ö. Demirel (Ed.), *Eğitimde yeni yönelimler* (pp. 271- 288). Pegem.

Zhang, J. (2016). The dark side of virtual office and job satisfaction. *International Journal of Business and Management, 11(*2), 40. http://dx.doi.org/10.5539/ijbm.v11n2p40

ORIGINAL RESEARCH

Curr Res Soc Sci (2022), 8(1) • 49-59

The Transformation of the Concept of Capital: A Critical Exploration Through Islamic Economics

Sermaye Kavramının Dönüşümü: İslam Ekonomisi Üzerinden Eleştirel Bir İnceleme

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Abstract

The purpose of this paper is to compare the understanding of capital in the 7th century Muslim societies and post-industrial era through exploring its meaning in the pre-modern period, in Muslim societies, and its later meanings. In doing this, the institutional logics is used as the conceptual framework of the study. In this paper, the capital term was discussed and examined in three periods: (1) in the 7th century Muslim societies with the help of the concept of Kasb; (2) following the emergence of the industrial revolution in the 18th century; and finally, (3) during the contemporary period. The concept of capital has various meanings from the beginning to the contemporary period. In the 18th century, with the emergence of the industrial revolution, even individuals and their labour were commodified, and the concept of human capital has emerged. Then, in the contemporary period, it is seen that besides humans, their social and cultural relationships are also commodified. In the last section, we critically evaluate the transformation of the concept of capital in the contemporary period and the commodification process in the light of Islamic economics. According to the Islamic economics perspective, the commodification of individuals in the form of human capital and treating a human as capital is not compatible with the morality of Islam. Furthermore, the social relations and the knowledge one possesses also should not be commodified. Islam, with its moral values and norms, prioritizes individuals in social life and their main objective, which is to be a servant to God.

Keywords: Capital, Commodification, Industrial Revolution, Islamic Economics, Social Capital, Human Capital, Cultural Capital.

Öz

Bu makalenin amacı, modern öncesi dönemdeki, Müslüman toplumlardaki anlamını ve sonraki anlamlarını keşfederek 7. yüzyıl Müslüman toplumlarında ve sanayi sonrası dönemde sermaye anlayışını karşılaştırmaktır. Bunu yaparken çalışmanın kavramsal çerçevesi olarak kurumsal mantıklar kavramı kullanılmıştır. Bu makalede ilk olarak sermaye terimi üç dönemde ele alınmış ve incelenmiştir: (1) 7. yy Müslüman toplumlarda Kasb kavramı yardımıyla; (2) 18. yüzyılda sanayi devriminin ortaya çıkmasıyla; ve son olarak, (3) çağdaş dönemde. Sermaye kavramı başlangıçtan günümüze kadar çeşitli anlamlara sahip olagelmiştir. 18. yüzyılda sanayi devriminin ortaya çıkmasıyla birlikte insan ve emek bile metalaşmış ve beşeri sermaye kavramı ortaya çıkmıştır. Daha sonra çağdaş döneme gelindiğinde insanın yanı sıra insanların sosyal ve kültürel ilişkilerinin de metalaştığı görülmektedir. Çalışmanın son bölümünde ise çağdaş dönemde sermayenin dönüşümü ve metalaşma süreci İslam ekonomisi ışığında eleştirel olarak değerlendirilmiştir. İslam ekonomisi bakış açısına göre bireylerin beşeri sermaye olarak metalaştırılması ve bireylere sermaye muamelesi yapılması İslam ahlakıyla bağdaşmamaktadır. Bunun yanı sıra İslam ekonomisine göre, toplumsal ilişkiler ve sahip olunan bilgiler de metalaştırılmamalıdır. İslam, içerisinde barındırdığı ahlakî değerler ve normlar ile sosyal hayatta bireyleri ve onların temel amacı olan Allah'a kulluk etmeyi ön planda tutmaktadır.

Anahtar Kelimeler: Sermaye, Metalaşma, Sanayi Devrimi, İslam Ekonomisi, Sosyal Sermaye, Beşeri Sermaye, Kültürel Sermaye.

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Article Info / Makale Bilgileri:
Received / Gönderim: 19.10.2021 Accepted / Kabul: 11.05.2022

To cite this article / Atıf için:
Topal, A., & Şencal, H. (2022). The transformation of the concept of capital: A critical exploration through Islamic economics. *Curr Res Soc Sci, 8*(1), 49-59.

To link to this article / Bağlantı için:
http://dx.doi.org/10.30613/curesosc.1012069

Introduction

In time, the attitudes of the individuals and their understanding of the concepts may change according to institutional logics in a specific society (Ocasio & Thornton, 2008, p. 101). Within this changing process, the concepts may gain new meanings. The capital, which is the main concept of this study, has gone through a similar process and both changed and expanded its meaning until the contemporary periods. In modern Arabic, *ra's al-mal* is used to provide the meaning of capital. Although the convergence of the societies due to the globalization and hegemony of the capitalist market system in the majority of the societies, including Muslim societies, led to the convergence of meanings of these two concepts, the meaning of *ra's al-mal* in Muslim societies in the pre-modern period was quite different. *Mal* (pl. *amwal*) or property was a tool to acquire earning (*kasb*) to supply the basic needs of life through halal and legitimate ways and fulfil the obligations toward Allah (Al-Shaybani, 1997, pp. 70–73). After the emergence of the industrial revolution in the 18th century, the meaning of capital has transformed in Europe and also expanded as a result of the increasing trade activity and the emergence of the capitalist market system. By looking at Adam Smith's book, it can be seen that in his definition of capital he implied that human capital is included into the production process and evaluated like machines (Smith, 1977, p. 368).

During the contemporary period in the 20th century, as an outcome of transformation and expansion of the meaning of capital, new types of capital have emerged in society, such as social and cultural capital (Bourdieu, 1986, p. 242). The relations of the individuals in the form of social capital started to be set up based on interest, and the core of the relations are degenerated. In each small tie, relations are aimed to be established with not sincere aims but interest. In terms of cultural capital, even the diploma and certificates became more vital than knowledge (Illich, 1972, p. 39). In the contemporary period, due to the hegemony of the capitalist market system globally, we understand the concept of capital in similar meanings with its expanded and modern form in both Muslim majority societies and others. Within the perspective of Islamic economics, however, these kinds of commodification processes are not acceptable. Instead, Islamic economics aims saving the values of labor, land and capital from commodification in order to establish a "re-embedded economy and society" (Asutay, 2016, p. 115). According to Islamic economics, the aim of the individuals is to serve Allah and the relations should be established in this context. This paper argues that Islamic economics does not accept an understanding of capital which commodifies individuals along with their relationships in the contemporary period, since Islam prioritizes individuals and their main purpose of worshipping Allah.

In the next section, the institutional logics is presented as the conceptual framework of the study. Then, in the third section, to demonstrate the transformation of the capital, the meaning of the capital in pre-modern Muslim societies and after the industrialization period are elaborated. In the fourth chapter, the meaning and scope of capital in the contemporary period is discussed, focusing on social and cultural capital. In the last section, we provide critical analysis of the contemporary meaning of capital from the perspective of Islamic economics to contribute to the literature. Lastly, the article finishes with the concluding remarks.

Conceptual Framework: Institutional Logics

The meaning of the concepts may change and transform into different understandings over time. In this study, the transformation of the concept of "capital" is explored before and after the industrial revolution with the help of the concept of "institutional logics", which emerged as a part of institutional theory in the 1970s. According to Thornton and Ocasio (Thornton & Ocasio, 1999, p. 804), institutional logics is defined as "the socially constructed, historical patterns of material practices, assumptions, values, beliefs, and rules by which individuals produce and reproduce their material subsistence, organize time and space, and provide meaning to their social reality." According to Friedland and Alford (1991, p. 248), institutional logics has a central logic

that is utilized both to constrain the means and ends of individual behaviours and constitute individuals, organizations and societies.

As a result of the set of rules and conventions that are formed by institutional logics, *"*rational, mindful behaviours*"* are shaped; however, actors do also have a role in shaping the institutional logics as well, leading to a bidirectional relationship (Ocasio & Thornton, 2008, p. 100). According to Ocasio and Thornton (2008, p. 101), like Friedland and Alford, Jackall also considers that institutional logics are embodied in the actions of the individuals, and cultural presumptions and political structure provide the continuity and reproduction of the institutional logics.

As the above discussion suggests, the institutional logics approach "provide[s] a link between individual agency and cognition and socially constructed institutional practices and rule structures" (Ocasio & Thornton, 2008, p. 101). Hence, the individual's behaviours and practices depend on the ideas, values, interests, and identities of the organizations that they belong to. Furthermore, since "individuals… provide meaning to their social reality", they also reproduce how they interact with the surrounding reality, including concepts such as capital. Therefore, there is a reciprocal relationship: On the one hand, different institutional logics leads to the outcome of various social realities depending on the prevalent institutional logics in a society (*e.g.*, capitalist market system vs religion), which, in return, shapes the individuals and how they perceive the reality. On the other hand, the individuals shaped in line with a particular institutional logics further produce and reproduce social reality and transform the meaning of the concepts, relationships and institutions in a particular society.

Since the topic of analysis in this study is capital, the study focuses on the transformation of the meaning of capital from the pre-industrial era to contemporary times in line with the changing institutional logics. In the pre-industrial era, the institutional logics of family and religion played a significant role in shaping the individual behaviour, which also defines how the society was organized, while during the industrial and post-industrial era, the institutional logics of corporate and nation-state directed the society and shape the values and concepts (Ocasio & Thornton, 2008, p. 108). Hence, in the following sections, it will be explored how the capital was perceived by the individuals in pre-industrial Muslim societies in the light of religion and how its meaning has transformed according to the changing institutional logics with the emergence of the market system and construction of nation-state institutions.

What is Capital?

Capital or *ra's al-mal* (رأس المال), which is the main discussion of this article, has had various meanings depending on the location and time. In modern Arabic, capital means *ra's al-mal*. However, since capital as a term has a particular meaning in the capitalist social formation following the industrial revolution, it is beneficial to present a general historical trajectory of *ra's al-mal* as a concept to explore its transformation until the contemporary period.

In the first section, the concept of capital during the pre-industrial era was explored. Due to the extent of the time and geographic locations, after the emergence of Islam as a religion the meaning of capital or *ra's al-mal* in Muslim societies is the point of focus. Then, in the second subsection, the meaning of capital after the 18th century following the industrial revolution until contemporary times is examined.

Muslim Societies Before the Industrial Revolution

In order to understand the meaning and utilization of *ra's al-mal* in pre-industrial Muslim societies, first, we need to examine a related concept, namely *kasb*. To achieve this, the first book written on this concept, *Kitab al-Kasb* written by al-Shaybani in the 8th century and expounded by al-Sarakhsi in the 11th century, is explored. According to al-Sarakhsi, *kasb* means "obtaining or acquiring goods through halal and legitimate ways" (Al-Shaybani, 1997, pp. 70–73). For al-Shaybani (1997, p. 71), "[i]t is mandatory for every Muslim to demand

kasb, just as it is fardh to demand knowledge." For Sabri Orman (2015, p. 37), here al-Shaybani tried to put emphasis on the importance of the *kasb* rather than the knowledge.

Al-Sarakhsi (Al-Shaybani, 1997, p. 70) remarked that "Allahu Ta'ala has made it fardh for people to work so that they can make a living, eventually, they can obey the orders." Thus, one has to acquire an income to be able to make a living and perform the worship. This attitude is attained to quite high degrees in Islam (Orman, 2015, pp. 27–28). However, there are restrictions and rules to be followed in the process of *kasb* (Al-Shaybani, 1997, p. 73). According to *Kitab al-Kasb* (Al-Shaybani, 1997, p. 140), there exist four ways to earn income through halal ways: rent (*ijarah*), trade, agriculture and artisanship. Although these methods are not at the same level in terms of benefits they provide to society, they are all considered permissible by scholars (Al-Shaybani, 1997, pp. 140–146). Two main concepts are important for the aim of this article related to four ways of income acquisition, namely *ra's al-mal* and *bidâa*.

The meaning of *"ra's al-mal"*, which is mentioned in the Qur'an (*The Qur'an*, 2004 Al-Baqara 2:279), means principal amount without any increase or decrease (1984, p. 95 vol. III). Considering that this verse is revealed about *jahiliyyah* practices (*i.e.*, the age of ignorance, the period before the emergence of Islam) on the interest, the principal amount refers to the original amount borrowed by the debtor in exchange of an excess, which is interest. Hence, in this verse, although it has a shared meaning with the capital concept of the modern period since capital might also be used to earn interest income, it does not refer to the amount invested with the objective of production or trade directly.

The concept of *ra's al-mal* mentioned in the chapter (*The Qur'an*, 2004 Al-Baqara 2:279) was defined by some commentators as follows: According to Ebû Hayyan (2010, p. 716 vol. II), who was a scholar living in the 14th century, *ra's al-mal* is "the original thing of goods." Ebû Hayyân (2010, p. 716 vol. II) stated the boundaries of *ra's al-mal* in his interpretation as follows: "…Interest is not actually a property, but an increase and an excess added to the property later." Ibn Âşûr (1984, p. 95 vol. III), a 20th century scholar, explained the concept of *ra's al-mal* according to the commerce contract in his commentary on Baqarah and stated the following for its use in 2/279: "… If there is interest in the principal, then the transaction will be void. In that case, the person will be given his money back. The original of the interest-free good is accepted as ra's al-mal." As it can be understood from above, Ebû Hayyân and Ibn Âşûr define *ra's al-mal* as the principal amount free of interest. In the books of Islamic law, we also find that *ra's al-mal* is used to represent the initial amount put forward in partnership agreements (Kāšānī & Tāmir, 2005, vol.7:507). However, it is important to note that unlike the partnerships of the modern period in the form of corporate structure, the partnerships mentioned in relation *ra's al-mal* in pre-modern Muslim societies are usually short-term and limited to the life of the partners.

On the other hand, the concept used for trade purposes is "*bidâ'a*" (Yusuf, 12/19, 62, 65, 88), which means "goods or commercial goods" (Erdogan, 1998, p. 43, cited in Habergetiren, 2005, p. 43). According to Ebû Hayyân (2010, p. 252 vol. VI), the concept of *bidâ'a* was explained in chapter Yusuf (12/19) as "the thing used for commercial purposes." Ibn Âşûr (1984, p. 243 vol. XII) also explains the same concept as "commercial goods." In addition, he interpreted Yusuf, 12/62 as follows: "... Its original meaning means commercial goods, but in this verse, it is used as a fee for which food is received..." Apart from these, Muhammed Ali as-Sâbûnî (1981, p. 44) defined the concept of *bidâa* as "commercial property" in Yusuf, 12/19. In sum, we can conclude that according to the view of the commentators, *ra's al-mal* represents the principal amount that is free of interest, which is impermissible according to Islamic law and considered as a vice in pre-modern societies in general (Hossain, 2009, pp. 241–242); however, it has also been used in Islamic law texts as initial amount to initiate a partnership or involve in a trading activity. As for *Bidâ'a*, it is mainly used for commercial goods. Until the industrial period, we observe that the scope and meaning of trade activities in Muslim societies such as the Ottomans are relatively stable (Kuran, 2011, pp. 64–65). However, thanks to the emergence of legal personality (Kuran, 2003) and the capitalist form of production, capital has

become a part of the never-ending production process and the pursuit of limitless profit (Wallerstein, 2014). Although some scholars such as Cizakca (2011) argue that these two features had existed in pre-modern Muslim societies due to a misinterpretation of pre-modern Muslim societies, the expansion of the scope of capital to include human, social and cultural features is a new phenomenon as well as qualitative nature of capital as an ever-expanding concept.

After the Industrial Revolution

As mentioned above, the institutional logics constructs the norms, beliefs, practices and assumptions and binding this; it shapes people's perception of life. In this study, it is argued that the reason for the change in the expansion of the meaning of capital is due to the transformation of the institutional logics following the emergence of the industrial revolution. At the end of the 18th century, the concept of capital has transformed to reflect the institutional logics prevalent in society, particularly the capitalist market system, and its consequences, such as the commodification of labour.

The transformation of capital is most evidently presented by Adam Smith in his distinguished book: "An Inquiry into the Nature and Causes of the Wealth of Nations (WN)." Smith divided capital into two groups, namely fixed capital and circulating capital. The former, fixed capital, was defined *as* "of which the characteristic is, that it affords a revenue or profit without circulating or changing masters" (Smith, 1977, p. 367). For instance, "fixed capital composes of useful machines and instruments of trade, profitable buildings, improvements of land and the acquired and useful facilities of the individuals of the society" (Smith, 1977, p. 368). The latter, circulating capital, was identified as "of which the characteristic is, that it affords a revenue only by circulating or changing masters" (Smith, 1977, p. 369). It consists of four parts: money, stock of provisions, materials and completed works (Smith, 1977, p. 369). According to Smith, no fixed capital can exist incessantly unless it is used on the market through circulating capital (Smith, 1977, p. 370). The elements of the fixed capital such as practical machines and trade instruments are based on the circulating capital which provides them to be in the circulation and keeping the workers who manufacture products in safe (Smith, 1977, p. 370). Namely, fixed capital is a piece of the circulating capital (Smith, 1977, p. 378).

On the other hand, Adam Smith (1977, p. 368) claims that since the talents and dexterities constitute the workers' fortune, those talents appertain to the society in which workers live. Smith goes a step further and asserts that the abilities of the workers resemble machines and evaluates them under the title of fixed capital (1977, p. 368). In line with these explanations, Hodgson (2014, p. 1065) remarked that even though Smith has never used the concept of "human capital" explicitly, he extended the notion of capital to individuals rather than just money or monetary values.

Apart from these, for Smith, the reason behind the success of the worker, in other words, the *productive powers of the labour*, derived from the division of labour effect (Smith, 1977, p. 17). The division of labour increases the performance and productivity of the workers (Smith, 1977, p. 19). Thanks to the division of labour, the same amount of worker can do more work and increase the production. Thus, through division of the labour in the production process, Smith aims to increase efficiency and productivity systematically.

Smith (1977, p. 368) regards workers and their abilities as "capital" which makes them a commodity in the production process and systematize this process in the light of the division of labour theory. Contrary to this, Karl Polanyi (2001, pp. 75–79) signifies that because the labour of human activity meant not to be a commodity, so they neither should be regarded as a commodity nor involved in the commodification process. Furthermore, not only labour, but also land and money which are the important elements of the industry are not meant to be a commodity as they do not exist with the purpose of buying and selling in the market (Polanyi, 2001, p. 79).

By looking at all implied and given meaning of the capital, we can come to the conclusion that the word of capital has gone through a transformation. Besides its basic meaning, which is wealth, money, monetary affairs

and principal used in trade activities, the sense of capital turned to a construct more related to accumulation, production and providing an income for the owner. For instance, according to Pasinetti (1983, p. 405), following the occurrence of the industrial revolution, the understanding of accumulation has varied, and the "accumulation of capital" concept emerged. Binding this, it may also be said that at the present time, capital accumulation has become related to economic growth and development (Korkut, 2018, p. 47). Furthermore, the accumulation of capital goods turned into a construct which is an important point in the market system (Pasinetti, 1983, p. 410).

While *bidaa'* or *ras'al mal* were just a means to meet the needs and religious worship in Muslim societies in pre-industrial period, after the industrial revolution, the meaning of capital has expanded, and its continuous accumulation has become an end in itself rather than a means. After the industrial revolution, transforming economic understanding has become dependent on capital. This kind of changing economic perspective started to alter and commodify human relations and the institutions in terms of the context of cultural, social and human capital.

Capital in the Contemporary Period

Following the industrial revolution, the meaning of the capital has transformed. The emergence of the market system transformed and commodified the things related to the production process, particularly money, land and labour (Polanyi, 2001, p. 72). As a result, workers started to be considered as one of the important capital tools in the production process (Smith, 1977, p. 368). Even though previously, the economic system was embedded in social relations, with the emergence of the market system, social relations have been embedded in the market system (Polanyi, 2001, p. 60). Thus, the submission of the society to the principles of the market system has transformed the society according to the economic principles including the institutions and relationships among individuals (Polanyi, 2001, p. 74). As an outcome of this transformation, in the course of time, not only workers but also their social relations have been converted into a type of capital. In this section, some outcomes of such a transformation in terms of relationships and institutions will be examined in the context of social, cultural, and human capital.

According to Bourdieu, capital may represent itself, within the convertibility process, in three forms such as *economic capital* which may become a construct by means of property rights, and transforms into money; *social capital*, which comprises of the social habitus, transforms into economic capital, and may be institutionalized within the border of the nobility title among individuals; and *cultural capital* which transforms into the economic capital in some circumstances and may be institutionalized within the border of the educational area (Bourdieu, 1986, p. 242). It may be concluded that Bourdieu classified the three forms of capital to emphasize their convertibility with each other, especially from cultural and social one towards the economic capital.

To begin with, social capital is comprised of a group of people having some identical features connecting each other with strong links and being a member of such a group ensures dignity and solidarity for each member (Bourdieu, 1986, p. 247). This kind of socially established groups may be exemplified such as family, club, tribe or a group with common objectives and targets (Bourdieu, 1986, p. 247). Because of the strong linkages of the individuals in terms of social capital, it is not necessary for people to know the whole other members. Probably someone will say that *"I know him well"* to someone who wants to meet him. Thus, the relations will spread more groups as a result of the strong linkages (Bourdieu, 1986, p. 249).

As for the cultural capital, Harker et al. (2016, p. 13) present its definition according to Bourdieu as "culturally-valued taste and consumption patterns." In the opinion of Bourdieu, cultural capital appears in three forms: *embodied* status, "in the form of long-lasting dispositions of the mind and body"; *objectified* status, "in the form of cultural goods (pictures, books, dictionaries, instruments, machines, etc.)" (Bourdieu, 1986, p. 243); and *institutionalized* status, when the embodied cultural type is evaluated in the educational area (Bourdieu,

1986, p. 243) such as academic certificates (Throsby, 1999, p. 4). Throsby (1999, p. 4) stated that the most fundamental type of cultural capital is *embodiment* as Bourdieu (1986, pp. 243–244) remarked that *"[m]ost of the properties of cultural capital can be deduced from the fact that, in its fundamental state, it is linked to the body and presupposes embodiment."*

According to Robbins (1991, p. 154, cited in Throsby, 1999, p. 4), embodied state of the cultural capital is near-synonymous with *human capital.* At this point, it will be beneficial to represent the definition of the human capital. Costanza and Daly (1992, p. 38) defined human capital as "the stock of education, skills, culture, and knowledge stored in human beings themselves." This kind of capital is crucial for us to specify the transformation point. As Hodgson (2014, p. 1065) argues, by treating the workers in the production process as a capital tool, Smith emphasized the commodification process of the workers and the emergence of human capital (Smith, 1977, p. 368). They were seen as productive resources and their labour was treated as productive powers of labour within the framework of the production process (Smith, 1977, p. 441). Even if Smith never used the concept of "human capital", for Hodgson (2014, p. 1065), he meant it in his writings. Not only Hodgson, but also Laroche and Mêrette (1999, p. 87) claimed that Adam Smith was the first classical economist who used the "human capital" concept in his capital definition. Additionally, Claudia Goldin (2016, p. 1) leant the human capital term on Smith because of the definition in the Wealth of Nations.

To sum up, following the emergence of the market system in the 18th century, the expansion of the meaning of capital has not been only limited to the commodification of labour and emergence of human capital but also transformed the society in order to perceive the social bonds and cultural heritage as a capital. Alongside its meaning as "monetary" (Fisher, 1904, p. 393), "capital stock and principal" (Cannan, 1921, p. 473), in the contemporary period, there also exists social, cultural and human capital types among other types of capitals.

A Critical Analysis of Capital in Muslim Societies from an Islamic Economics Perspective

In this part, it will be critically evaluated the concept of capital and its transformation from pre-modern Muslim societies to modern Muslim societies. In pre-modern Muslim societies, the capital in the form of trade goods and money was used as a tool to meet the necessary things and requirement of mandatory worship. Also, it was used to become beneficial to others in the community. The main purpose was to carry out worship, which is not limited to the ritual but consists of every action one does. Hence, income generation was just a means to an end rather than an end in itself. As a result of the emergence of the capitalist market system and its hegemony over society, institutional logics has changed. As a source of growth, the never-ending accumulation of capital has become a crucial element of the modern economy (Prendergast, 2010, p. 428). At this point, it should also be said that the modern economics perspective considers labour as a commodity that is merchandised in the market (Korkut, 2018, p. 44).

Although the division of labour is seen as perfectly beneficial and useful for the production process at the beginning of Wealth of Nations, at the end of the book, Smith points out the negative effects of it. During the division of labour process, a great number of workers restricted to quite simple operations, and they spent their life with these same plain activities. The effects they gain from those activities are always or almost will be the same (Smith, 1977, p. 1040). Hence, increased production efficiency due to the division of labour comes at the expense of the well-being of labour. Furthermore, there is an ontological problem as well, which many of the theoreticians of human capital neglects in their criticism: Labour is not meant to be a capital to sustain the never-ending production process (Polanyi, 2001, pp. 75–79). Such an ontological transformation forms the basis of many contemporary institutions and relationships in the society, which are considered as problematic from an Islamic economics perspective.

In the contemporary period, besides people, even the most minute values individuals have in life have transformed and commodified in the form of social, cultural, and human capital as an outcome of changing institutional logics. Social capital, which is a type of the capital for Bourdieu, provides privileges in terms of

dignity and solidarity (1986, p. 247) for those who are the member of the same group in certain specific areas. However, these kinds of privileges may disrupt the base of relations and are not what Islamic economics aims for relations in the society. Contrary to this, Islam aims "justice, social equity, brotherhood, charity and co-operation" (Asutay & Zaman, 2009, p. 74) and "social justice and well-being" (Asutay, 2010, p. 189) in societies. However, the privileges which occurred in the sphere of social capital, led individuals to start creating a tie with those who have some good qualities and are positioned in society's high class, not as an outcome of sincere sentiments but self-interest. Because the aim of the relations, such as friendship and neighbourhood, changed and based on the convertibility into the economic capital, the relationship between individuals and their relatives are commodified. For instance, friendships might have started with the objective of social network; social relations have become a tool to find a job and have a position somewhere. As a result, today, within the context of relations, social capital has turned into something that harms the organic relationships among the members of society.

In the framework of the institutionalized state, cultural capital distinguishes in the field of education and academic understanding. Furthermore, some academic credentials such as diploma and certificates became more essential than knowledge in educational and academic fields as an extension of cultural capital. As a result, educational institutions are commodified into the fields to be supplied such documents and the significance of the knowledge became limited to these documents. However, from the perspective of Islamic economics, the commodification of knowledge and limiting knowledge to the certificates are not advocated and envisioned from the Islamic economics perspective. At this point, the argument put forward by Ivan Illich in *"Deschooling Society"* is important. Looking at the evaluation of Illich (1972, p. 22), it is seen that as an outcome of the schooled society, evaluating the competence of individuals becomes restricted to a diploma. Furthermore, educational institutions turned to a construct that is regarded according to grades and certificates rather than knowledge (Illich, 1972, p. 39).

On the other hand, with today's education system, since it mainly aims to produce workers, education is away from moral values. In other words, they aim to educate individuals in the most efficient way and increase their human capital skills with the lowest possible cost. On the contrary, moral values and norms in Islamic economics are as substantial as knowledge for individuals in society. They neither can be commodified nor disregarded. Nowadays, however, morality is not a part of education in academic institutions. In this context, the word of Harry Lewis may support this argument. Lewis (2007, pp. 97–98) argued that the curriculum of Harvard University is away from moral values and ethics. Thus, although knowledge is at the centre of education, moral values are not. This is not an issue that Islamic economics can permit.

Within the scope of the human capital term, which is implicated under the title of the embodied state of cultural capital by Bourdieu (1986, p. 243), individuals consider themselves as a capital tool and struggle to improve themselves in terms of skills and knowledge. The reason for it, they need to have money and a job to maintain their life. Only if they have such skills, they will be preferred as an employee by the companies. And eventually, they will be able to contribute to the capitalist market system.

While the main goal to acquire new skills and improve the existing ones was to earn an income to sustain life and fulfil the obligations set by the religion and socially agreed upon (*e.g.*, religious duties as well as cooperation and collaboration within the community) in the past, in the modern period, individuals seek to acquire new skills and knowledge to promote their positions in the society and increase their income without any upper limit. Nowadays, people see themselves as an input of the production process, which requires a never-ending accumulation of capital, both in terms of money and human capital. However, in Islamic economics, treating individuals as capital is not acceptable as human beings are valuable and created with a particular purpose: worshipping Allah. Also, the ultimate aim of individuals is to gain the consent of Allah (Asutay & Yilmaz, 2021, p. 20). Hence, they cannot be treated as -human- capital. At this point, it is true that individuals have to earn money to sustain their lives, but their main target should be serving Allah. However,

for individuals, the main aim of obtaining these skills has changed and become acquiring financial gain by converting these skills and knowledge into economic capital.

Concluding Remarks

In time, the meaning of the concepts may change. Individuals may attribute a different content to concepts because of the changed behaviours, beliefs, and traditions in society due to the institutional logics (Thornton & Ocasio, 1999, p. 804). Because of changing values and identities due to the changes in prevalent institutional logics in the societies, the understanding of capital has gone through a transformation and its scope and meaning have expanded. In our study, we tried to critically compare the key meaning of capital in pre-industrial Muslim societies and post-industrial period from an Islamic economics perspective.

In modern Arabic, the capital is translated as *ra's al-mal*, and it has a similar meaning to its English counterpart in contemporary period. However, the meaning of *ra's al-mal* in Muslim societies in pre-industrial period was quite limited. The *ra's al-mal* meant principal amount without any increase or decrease. Furthermore, when it is used to earn money in the form of *bidaa'* (commercial goods), the ultimate objective was to acquire income to meet the needs through halal and legitimate means (Orman, 2015). In other words, both its meaning and the purpose of utilization were different from its contemporary meaning in Arabic. After the industrial revolution in the 18th century, the meaning of the capital has expanded to encompass, for instance, human as capital.

On the other hand, besides human capital, new types of capital have entered into circulation such as social capital and cultural capital in the 20th century. While the term of capital whose meaning was related to monetary things in the pre-modern period, now it even includes the relations among friends, relatives and neighbours through social capital, which can be converted into economic capital. For the type of cultural capital, the diploma and certificates have become more important than the knowledge, which can be presented as tangible evidence of knowledge by a person, even though the person lacks the knowledge.

By looking at the types of capital in the contemporary period, one may consider that in this period, capital survives by transforming its power into symbolic commodities and preserves its existence. As an outcome of the transformation in the capital term, the relationships in society started to set up in line with self-interest and benefit. In Islamic economics, however, the aim of human is to be a servant to Allah, and humans establish all the relationships in this context. Therefore, it should be acting in accordance with the consent of Allah in the basis of one's relationship with himself and his immediate surroundings rather than the motivation to accumulate capital.

In this context, the perception of an individual himself or herself as one of the inputs for production; or establishing relationships by seeing friends and immediate surroundings as individuals whom they can turn into economic capital in the future are not the types of relationships Islamic economics envisions in society. Apart from these relations, educational institutions should not be a tool of a certificate-focused schooling process on cultural capital accumulation; rather, they should be in accordance with an educational curriculum that will guide the way in the seeking for truth and being servants of Allah instead of being part of a capitalist production process. In other words, Islam with its moral values and norms prioritizes individuals in social life and their main objective, which is to be a servant to God.

References

Al-Shaybani, M. b. el-Hasan. (1997). *Kitab al-Kasb*. Mektebu'l-Matbuât el-İslamî.

Asutay, M. (2010). *Conceptualisation of the second best solution in overcoming the social failure of Islamic finance: Examining the overpowering of homoislamicus by homoeconomicus* (SSRN Scholarly Paper ID 1693608). Social Science Research Network.

Asutay, M. (2016). Defining and framing Islamic economics as Islamic moral Economy: An attempt to embed public policy in Islamic economics to generate emergence science. *Share Journal of Islamic Economics and Finance*, *5*(2), 103-123.

Asutay, M., & Yilmaz, I. (2021). Constituting an Islamic social welfare function: An exploration through Islamic moral economy. *International Journal of Islamic and Middle Eastern Finance and Management*, *14*(3), 524-540.

Asutay, M., & Zaman, N. (2009). Divergence between aspirations and realities of Islamic economics: A political economy approach to bridging the divide. *IIUM Journal of Economics and Management*, *17*(1), 73–96.

Bourdieu, P. (1986). *The forms of capital* (By J. G. Richordson; pp. 241–258). Greenwood Press.

Cannan, E. (1921). Early history of the term capital. *The Quarterly Journal of Economics*, *35*(3), 469–481.

Cizakca, M. (2011). *Islamic Capitalism and finance: Origins, evolution and the future*. Edward Elgar.

Costanza, R., & Daly, H. E. (1992). Natural capital and sustainable development. *Conservation Biology*, *6*(1), 37–46.

Ebû Hayyân. (2010). *El-Bahru'l-Muhît*. Dâru'l-Fikr.

Fisher, I. (1904). Precedents for defining capital. *The Quarterly Journal of Economics*, *18*(3), 386–408. https://doi.org/10.2307/1884076

Friedland, R., & Alford, R. R. (1991). Bringing society back in: Symbols, practices, and ınstitutional contradictions. In Powell, W. W. & DiMaggio, P. J. (Eds.), *The New Institutionalism in Organizational Analysis*, (pp. 232-263), The University of Chicago Press.

Habergetiren, Ö. F. (2005). *İslam hukuku'nda sermaye ve sermaye hareketleri (Sermayenin oluşumu, birleşmesi ve bütünleşmesi)* [Doctoral Dissertation]. Harran University.

Harker, R., Mahar, C., & Wilkes, C. (Eds.). (2016). *An ıntroduction to the work of Pierre Bourdieu: The practice of theory*, Palgrave Macmillan UK.

Hodgson, G. M. (2014). What is capital? Economists and sociologists have changed its meaning: Should it be changed back? *Cambridge Journal of Economics*, *38*(5), 1063–1086. https://doi.org/10.1093/cje/beu013

Hossain, M. Z. (2009). Why is interest prohibited in Islam? A statistical justification. *Humanomics*, *25*(4), 241-253.

Ibn Âşûr. (1984). *Et-Tahrîr ve't-Tenvîr*. ed-Dâru't-Tûnusiyye li'n-neşr.

Illich, I. (1972). *Deschooling Society*. Harrow Books.

Kāšānī, A. B. b. M. al-, & Tāmir, M. M. (2005). *Badā'i' al-ṣanā'i' fī tartīb al-šarā'i'*. Dār al-Ḥadīṯ.

Korkut, C. (2018). *İslâm ekonomisinde sermaye oluşumu, birikimi ve yapısı: Fon biriktirmede Türkiye için model ve politika önerileri* [Doctoral Dissertation]. Istanbul Sabahattin Zaim University.

Kuran, T. (2003). The Islamic commercial crisis: Institutional roots of economic underdevelopment in the Middle East. *The Journal of Economic History*, *63*(2), 414–446. https://doi.org/10.1017/S0022050703001840

Kuran, T. (2011). *The long divergence: How Islamic law held back the Middle East*. Princeton University Press.

Laroche, M., Mérette, M., Ruggeri, G. C., & Merette, M. (1999). On the Concept and dimensions of human capital in a knowledge-based economy context. *Canadian Public Policy / Analyse de Politiques*, *25*(1), 87-100. https://doi.org/10.2307/3551403

Lewis, H. R. (2007). *Excellence without a soul: Does liberal education have a future?* Public Affairs.

Muhammed Ali as-Sâbûnî. (1981). *Safvetu't-Tefâsîr*. Dâru'l-Kurâni'l-Kerîm.

Ocasio, W., & Thornton, P. H. (2008). Instituonal logics. In Greenwood R., Oliver C., Suddaby R., Sahlin-Andersson K. (Eds.), *The Sage Handbook of Organizational Institutionalism*, (pp. 99-128), SAGE Publications Ltd.

Orman, S. (2015). İslam entelektüel geleneğinde iktisadi boyutun teşekkülü: Şeybani, Serahsi ve Kitabu'l-Kesb (II). *İslam Ekonomisi ve Finansı Dergisi*, *1*(2), 23–67.

Pasinetti, L. L. (1983). The accumulation of capital. *Cambridge Journal of Economics*, *7*(3/4), 405–411.

Polanyi, K. (2001). *The great transformation*. Beacon Press.

Prendergast, R. (2010). Accumulation of knowledge and accumulation of capital in early 'theories' of growth and development. *Cambridge Journal of Economics*, *34*(3), 413–431. https://doi.org/10.1093/cje/bep009

Smith, A. (1977). *An inquiry into the nature and causes of the wealth of nations*. University of Chicago Press.

The Qur'an (M. A. S. Abdel Haleem, Trans.). (2004). Oxford University Press.

Thornton, P. H., & Ocasio, W. (1999). Institutional logics and the historical contingency of power in organizations: Executive succession in the higher education publishing industry, 1958–1990. *American Journal of Sociology*, *105*(3), 801–843. https://doi.org/10.1086/210361

Throsby, D. (1999). Cultural capital. *Journal of Cultural Economics*, 23, 3-12.

Wallerstein, I. M. (2014). *Historical capitalism: With capitalist civilization*. Verso Books.