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Vahid Kabiri
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The investment opportunities in clean energy in the European Union

Primary Supervisor: Tibor László Csegődi
Assistant lecturer

Author: Vahid Kabiri
GTY145

Institute: Agricultural and Food Economics

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ABSTRACT OF THESIS

The investment opportunities in clean energy in the European Union

Vahid Kabiri

MSC Environmental Engineering

Institute of Environmental sciences

Tibor László Csegődi, Assistant lecturer, Institute of Environmental sciences

Keywords: Clean Energy, Investment, Opportunity, Environmental Problem, Sustainable Energy

Abstract

In today's world, the demand for energy has risen due to the growing global population. However, the limited availability of fossil fuels and the negative impact of greenhouse gas emissions on the environment make it imperative to focus on clean energy sources to achieve sustainable development goals (Amini & Amoozadeh Khalili, 2021).The finite nature of fossil fuels and their contribution to climate change have led to increased attention towards clean energy (Zhou, et al., 2010).The Paris summit on climate change in 2015 highlighted the key role that renewable sources of clean energy can play in reducing the impact of climate change on the environment. Furthermore, the use of renewable resources for clean energy can also create economic opportunities, according to many international environmental and energy organizations. The increase in population, limited fossil fuel resources, and growing demand for energy have led countries to invest in sustainable energy supplies and reduce their dependence on fossil fuels. Considering the importance of choosing renewable energy sources to replace fossil fuels, the European Union member states need to formulate suitable policies for evaluation, selection, and development of these energy sources. To achieve this, the researcher aims to identify the factors affecting investment opportunities in clean energy in the European Union and prioritize them using the Analytical Hierarchy (AHP) technique. By examining research from other developed countries and learning from their experiences, the researcher hopes to provide valuable knowledge for the proper development of clean energy sources in the member states of the European Union.

1 Research overview

1-1 Introduction

In the present day, our planet is experiencing unique environmental circumstances as a result of global warming. The ramifications of climate change and global warming over the past decade include heightened occurrences of storms and other weather phenomena, a scarcity of potable water, an increase in air temperature, a surge in sea levels, and more. As a result, social movements, organizations, countries, and international assemblies have recognized the ethical obligation to alter our approach to energy usage and adopt sustainable resources in the long term while limiting carbon dioxide emissions. Consequently, over 65 countries have pledged to eliminate their carbon emissions by 2050 (Davari, , 2020). Given that energy is the primary driving force behind many production and service activities and plays a crucial role in economic growth and development, policymakers aim to achieve this goal. The use of cleaner primary energy sources has become a significant issue in the literature on economic growth, owing to their environmental benefits. As a result, most countries worldwide are implementing legal frameworks to promote the adoption of renewable energy sources, in line with the objectives of the International Energy Agency and the Kyoto Agreement. Enhancing energy supply and demand in developing nations, transitioning to cleaner energy sources, and boosting energy consumption efficiency are among the top priorities in this regard (Maji, 2015).

From the above text, it is apparent that identifying and prioritizing the primary and secondary factors of investment opportunities in clean energy within the current global energy landscape can significantly contribute to the growth and development of the European Union's member states. Thus, this study focuses on identifying and ranking the critical and ancillary factors that influence investment opportunities in clean energy within the European Union. This study comprises five chapters that explore the aforementioned topic. The initial chapter outlines the general aspects of the research, including the problem statement, the research purpose, objectives, research questions, and definitions of the research variables. Furthermore, this chapter provides an overview of the research methodology, data collection techniques, and statistical population.

1-2 Statement of the problem

In recent times, the global population surge has led to an increase in the demand for energy. However, with the finite resources of fossil fuels and the environmental issues caused by greenhouse gas emissions, there is a growing need to focus more on clean energy sources. By doing so, the objectives of sustainable development can be achieved (Amini & Khalili, 2021). Due to the fact that the fossil fuel resources required for electricity generation are finite and climate changes are related to carbon pollutants, therefore, the finiteness of these sources and environmental pollution has increased attention to clean energy (Zhou, et al., 2010). Driven by the urgency to limit global warming to below 2 degrees Celsius, numerous environmental and energy specialists convened at the 2015 Paris Climate Conference. During this gathering, it was emphasized that renewable energy sources could serve as a crucial element in mitigating the impacts of climate change on the environment. Furthermore, many international environmental and energy organizations, including the International Energy Agency, view the adoption of clean energy from renewable sources as a means of stimulating economic growth. The rise in global population coupled with the limited availability of fossil fuels and the growing demand for energy in production and service sectors has prompted countries to prioritize sustainable energy investments. Additionally, the potential risks associated with climate change and global warming have further heightened the importance of transitioning to clean energy sources and reducing dependence on fossil fuels for energy supply (Kahia, et al., 2017).

Throughout the course of human history, there have been numerous transformations in the way people live their lives. One common thread amongst all these changes is the extensive and uninterrupted consumption of energy. Energy is a fundamental component of all aspects of the contemporary economy and thus, impacts all our economic activities. However, if present patterns persist, it is anticipated that global energy demand will double by the year 2050 (Bafandeh Imandoust, et al., 2020). The governments of European Union member states consider it crucial to choose a renewable energy source that can replace fossil fuels, thereby reducing their dependence on non-renewable energy sources. In order to achieve this goal, it is essential to formulate a suitable policy for the evaluation, selection, and development of renewable energy sources. Examining research conducted in other developed countries and incorporating lessons learned from them can significantly contribute to the knowledge and foundation necessary for developing renewable energy sources in EU member states. This research aims to address the following questions: What are the factors influencing investment opportunities in clean energy in the European Union? What is the current status of prioritizing these main and secondary factors using the Analytical Hierarchy Process (AHP) technique?

1-3 Importance and necessity of research

Energy has become a crucial and influential topic in today's world, serving as a fundamental element of modern society and impacting human behaviour. It holds significant importance for the economic and social growth of nations and plays a crucial role in enhancing the overall standard of living globally (Cheraghi & Choobchian, 2018). In the past few years, a number of countries, particularly developed ones, have attempted to implement various policies related to clean energy. These policies, such as guaranteed purchase policies and clean energy standard RPS, provide a foundation for the development of clean energy. Although the initial costs of producing clean or renewable energy are high, the increase in GDP resulting from using this type of energy can offset these costs and lead to more sustainable and dependable economic growth. As a result, investing in clean energy opportunities is potentially significant for developed countries (Daei-Karimzadeh, et al., 2021).And the transition to large-scale renewable energy is a necessity in order to mitigate climate change (Yeganegi & ghasemloo, 2022). The aim of achieving sustainable energy for all by 2030 has been emphasized by the United Nations General Assembly, which entails ensuring worldwide access to modern energy services and increasing the proportion of renewable energy in the global energy mix by two-fold (Atems & Hotaling, 2018).

This scientific research serves two functions and is necessary for two reasons. Firstly, it has a cognitive aspect, which means it aims to enhance the existing knowledge about the factors that influence investment opportunities in clean energy in the European Union. This will help energy experts, investors, and managers in the field of energy, as well as organizations interested in this field, to have a better understanding of this particular issue. Secondly, it has a practical aspect, which means it aims to solve problems. The findings of this research will aid investors who are interested in participating in the production of clean energy in the European Union to achieve their goals with informed planning.

1-4 Research purposes

- Identifying the most important factors for achieving investment opportunities in clean energy in the European Union.

- Ranking (prioritization) of the main and secondary factors affecting the achievement of clean energy investment opportunities in the European Union based on the Analytical Hierarchy (AHP) method.

1-5 Research questions

In this particular research, there were no hypotheses to be tested due to its nature as a multi-criteria decision-making study. Instead, the research sought to answer two main questions using the Analytical Hierarchy (AHP) method:

- What are the available investment opportunities in clean energy within the European Union?

- How can the main and secondary factors influencing the achievement of these investment opportunities be ranked and prioritized using the Analytical Hierarchy (AHP) method?

1-6 Target population

The intended audience for this research comprises all professionals, including researchers, theoreticians, investors, managers, senior managers, and experts who are working in the energy supply industry in the member countries of the European Union. The decision team, consisting of experienced and capable individuals, is selected from the target community, including senior managers and experts, with a maximum of 30 participants. The questionnaire is distributed and collected among the decision team. For this research, the existing sample of 20 experts in the field of research will be utilized.

1-7 Methods and tools of information collecting

The research data was obtained through a combination of library research and fieldwork. To collect the necessary information, a specialized questionnaire was designed using the AHP hierarchical analysis format. This format involved a nine-point scale and two-by-two comparisons, and it was used after identifying the main and secondary factors.

1-8 Data analysis method

This study used multi-criteria decision-making models for data analysis, which are based on mathematical arguments. The main and secondary factors affecting the acquisition of clean energy investment opportunities in the European Union were identified through group decision-making methods, such as Delphi and brainstorming, among experts who are familiar with the field of clean energy. These factors were collected using an AHP questionnaire, and decision-making matrices were created by combining the opinions of these experts using the geometric mean. The value of options and factors were measured against each other, and the priority of each option was determined hierarchically based on the higher value. Data analysis was performed using the Expert Choice Team and Excel software. It's important to note that the experts were selected from universities and organizations that are active in the field of energy. In this study, two software programs were used based on their specific capabilities and the requirements of the research:

1. The Team Expert Choice software was utilized for multi-criteria decision-making models, specifically for obtaining and combining matrices from multiple individuals to generate a single matrix using geometric means. This software can also calculate the incompatibility rate for each matrix pair.
2. The Excel software was chosen for its computational capacity to carry out calculations on data presented in decision-making matrices in the Analytical Hierarchy Process (AHP) method.

1-9 Conceptual definitions of research variables

-Opportunity, as defined in a layman's dictionary, refers to a favourable moment or a favourable set of circumstances that allow for the completion of work or the achievement of a desired outcome (Chung, 2007).

-Investment, in economics, refers to the act of distributing financial resources among one or multiple assets with the aim of acquiring more valuable resources in the future (bodaghi, et al., 2020).

-Clean energies, in the division of energy sources, it is possible to refer to energy production through renewable sources (new or clean energies) such as wind energy, solar light and heat, geothermal energy, sea tides (Marques, et al., 2010).

-The method of determining the importance of indicators, Thomas L. Saaty proposed a method called Hierarchical Analysis Process, which uses human brain analysis to determine the importance of indicators in complex problems. Saaty suggests breaking down complex problems into smaller ones and establishing a system of preference between indicators through paired scales. Then, a logical compatibility between measurements should be established. The AHP method involves four main steps, which are modelling, preference judgment, calculation of relative values, and integration of relative values (Asgharpour , 2022).

2 Theoretical literature and research background

Providing adequate energy is a crucial factor that greatly impacts international relations and the development of nations in modern times. Currently, non-renewable energy sources such as fossil fuels, which account for 90% of the world's energy supply, are depleting rapidly and their prices are influenced by the world's political and economic situation. The use of such energy sources raises concerns about security of supply, pricing, and most importantly, environmental issues such as air pollution and global warming. This has prompted governments to shift their focus towards renewable energy sources, which are sustainable and do not have the negative impacts associated with fossil fuels. Clean or renewable energy refers to the type of energy that can be replenished by nature in a short time and does not deplete over time. Renewable energy sources include wind, solar, water, geothermal, and biomass energies (Movahed & Rafiei, 2018). For policymakers and officials involved in the energy sector, an important challenge is selecting a suitable renewable energy source and devising an appropriate policy for its deployment in different regions of the European Union, considering various factors such as the prevailing climatic conditions, processing costs, and required technologies. In situations where decision-makers confront multiple and sometimes conflicting criteria, multi-criteria decision-making techniques can prove useful in selecting the optimal solution. The present study aims to explore the issues related to clean and renewable energy sources, review some of the most important research in this field, and prioritize investment opportunities in clean energy. Given the significance of the aforementioned content in determining the success rate of investment opportunities in clean energy within the European Union, this study aims to identify and rank the factors that affect such investment opportunities. This chapter discusses the theoretical concepts, definitions, and theories related to the research variables. Additionally, the chapter provides an overview of the internal and external context of the research.

2-1 The importance of energy in the world

Energy is the main driving force behind most production and service activities, playing a crucial role in economic growth and development, which is a key goal for policymakers. Given the importance of economic growth and development, there is a growing interest in the use of primary energy sources that have minimal impact on the environment. As a result, there is a significant focus in the economic growth literature on promoting the use of clean energy sources. Many countries worldwide are taking measures within the legal framework to incentivize individuals and businesses to adopt clean energy sources, in alignment with the objectives of the International Energy Agency and the Kyoto Agreement. The top priorities among these goals include improving energy supply and demand in developing nations, substituting cleaner energy sources, and enhancing energy consumption efficiency (Maji, 2015). It should be emphasized that the Middle East and North Africa area holds approximately 57% of the worlds confirmed oil reserves and 41% of its confirmed natural gas reserves. Moreover, energy production and consumption account for about 58% of the total greenhouse gas emissions in this region (Kahia, et al., 2019). The environmental issues in this region are compounded by the significant subsidies on petroleum products (Farzanegan & Markwardt, 2012). Based on the World Bank's report, fuel subsidies in Morocco, Yemen, and Egypt exceed public health costs by a factor of 2 to 7.5. In 2007, Iran provided the largest subsidies for fossil fuels. The price difference for fossil fuels in Yemen, Bahrain, Egypt, Saudi Arabia, Iran, Kuwait, Libya, Qatar, and Algeria has been between 58% and 97% compared to the global average price. This substantial subsidy has resulted in high levels of energy consumption in production and an over-reliance on fossil fuels. Therefore, substituting renewable energy sources for some of the fossil fuel energy can mitigate the negative impacts caused by the excessive use of fossil fuels in MENA countries (Bank, 2012). (Kraft & Kraft, 1978) Introduced the notion of a potential correlation between energy consumption and economic growth, in which he examined the causal link between these two variables in the United States. Since then, scholars in the field of energy economics have extensively investigated the causal relationship between energy consumption and economic growth (Fotros, et al., 2012).

Neoclassical economists have asserted that energy is a key factor in the production function. (Stern & Cleveland, 2004) Cites ecological economists, such as (Ayres & Nair, 1984), who argue that energy is not only the most important factor of growth but also the sole factor. Consequently, the production of goods in the economy requires a significant amount of energy, even when utilizing unskilled labour. Meanwhile, neoclassical economists like (Berndt, 1978)and (Denison, 1979) contend that energy has an indirect impact on economic growth by influencing labour and capital. Within the neoclassical framework, (Stern & Cleveland, 2004)have presented the relationship between energy consumption and economic activities as a production function (Fotros, et al., 2012). It can be asserted that economic growth in any country leads to a rise in energy demand. Thus, the level of economic activity and its growth play a significant role in determining the consumption of renewable and non-renewable energy sources in any country. The energy consumption pattern in developed countries indicates that their overall energy consumption has risen, but the consumption of fossil fuels has decreased due to the emission of greenhouse gases.

2-2 The Clean energies

Renewable energy is a valuable resource for the world, providing diversification in countries' energy portfolios and the potential for reduced reliance on fossil fuels, which can be exported instead. As a result, international policies promoting global sustainable development have placed a significant emphasis on the use of renewable energy sources (UNEP, 2011). Renewable or clean energy is the energy derived from natural sources such as sunlight, wind, rain, sea tides, and geothermal heat. Unlike non-renewable energy sources, renewable energy is widely available globally. The widespread use of renewable energy and technological diversity of energy sources can contribute to energy security and economic benefits (Shilpa, et al., 2015).

To differentiate from non-renewable energy sources, renewable energy refers to forms of energy that can replenish themselves naturally, such as wind, solar, geothermal, biomass, biofuel, and hydroelectric power. These energy sources hold enormous potential in meeting global energy demands. Compared to fossil fuels, the clean nature of renewable energies makes them an attractive option for stimulating economic growth, addressing energy needs, generating employment opportunities, and fostering the development of manufacturing and service industries, particularly in developing nations (SATBA, 2016).

2-2-1 Types of clean or renewable energy

At present, there are several forms of renewable energy sources used for electricity generation, including biomass, solar, geothermal, wind, and ocean energy. It is projected that renewable sources will constitute over 80% of the global energy supply by 2050. In the following sections, each type of renewable energy source will be discussed in terms of its potential for generating electricity.

2-2-1-1 The Hydroelectric energy

Hydroelectric power is considered as a cost-effective renewable energy source, as it relies on dams and water flow to generate electricity, and is therefore not affected by unpredictable fluctuations in energy prices. It is also an environmentally-friendly energy source as it does not produce harmful air pollutants or toxic gases. Despite its advantages, hydroelectric power plants are associated with social and environmental issues, such as displacement of local communities, loss of agricultural land, soil erosion, and disturbances to ecosystems. Furthermore, the installation of a hydroelectric power plant requires a large area for water storage (Gleick & Adams, 2000).

2-2-1-2 Wind energy

The rising awareness about environmental protection and economic benefits associated with the use of renewable energy has led to a significant growth of wind energy adoption in many countries worldwide. Compared to other renewable energy sources, wind turbine technology is relatively affordable, making it a favourable option. However, wind energy also has some drawbacks. These include electromagnetic interference on radio signals in areas near large wind farms and noise pollution generated by the turbine blades (Schilling & Esmundo, 2009).

2-2-1-3 Solar Energy

Solar energy is a significant source of renewable energy that can provide a promising future for countries to achieve self-sufficiency and reduce dependence on oil exports. Solar power plants have several advantages, including electricity production without fuel consumption, low water consumption, no pollution, suitability for small and regional networks, low maintenance, and not requiring specialized expertise. Solar energy is considered the cleanest form of electricity generation. Nevertheless, the production of solar cells can cause environmental issues if not done properly (Kadir & Rafeeu, 2010).

2-2-1-4 The Geothermal energy

Geothermal energy refers to the heat that exists under the earth's surface. Despite the existence of high potential for geothermal energy utilization in many parts of the world, the lack of large-scale policies in the field of renewable energy, inadequate technology for deep drilling, reservoir engineering, construction, and operation of geothermal power plants, as well as fierce competition with cheap fossil fuel sources, have hindered the exploitation of these potentials. The advantages of using geothermal energy in electricity production include being clean, requiring less space for power plant construction, being reliable and active even during bad weather, natural disasters, or political tensions, being renewable and permanent, and saving currency while helping the growth of developing countries. However, the use of geothermal energy can cause environmental pollution due to the gases emitted from the ground that pollute the air and produce sediments on the ground (SATBA, 2016).

2-2-1-5 Biomass energy

Biomass, derived from agricultural products, residues, wastes, forests, and related industries, is a significant source of renewable energy. It is biodegradable and includes both plant and animal materials. The use of biomass for energy is appealing for economic, environmental, and developmental reasons, and it is seen as a way to promote sustainable development. Biomass is mainly found in agriculture and forestry industries, which can provide opportunities for the economic development of rural and remote areas. The emission rate of pollutants from biomass combustion is generally lower than that of fossil fuels. Additionally, commercial use and exploitation of biomass can help address waste problems in various industries, including forestry, wood products, food processing, and solid waste in urban centers (SATBA, 2016).

2-2-1-6 Biogas energy

Bio-gas is a mixture of gases generated from the anaerobic decomposition and fermentation of various materials that fall into the biomass category, such as human, animal, and plant waste. This gas is produced due to the absence of oxygen and the presence of anaerobic bacteria. The organic compounds in the biomass sources are broken down into simpler molecules through a process called anaerobic organic fermentation, resulting in the production of a combustible gas called bio-gas (SATBA, 2016).

2-3 investment opportunities

According to investment researchers, opportunity identification plays an important role in investing (Alonso, et al., 2016). According to (Scott & Scott, 2016), recognizing a good idea and developing it into a business concept that offers value and economic returns is what identifying an opportunity means. Various definitions of investment opportunities have been provided, each focusing on a particular aspect. Oxford culture defines an opportunity as a favourable condition, a turning point, or a time to accomplish a goal or encounter something that is beneficial and desirable.

In addition, Webster's definition of opportunity refers to circumstances and situations that can result in growth and advancement. According to (Sarasvathy, et al., 2003), an investment opportunity involves certain concepts and convictions that enable the creation of new goods and services in markets where they do not currently exist (Li, et al., 2015). (Vesper, 1993)Regards opportunity as the space between the current state and the future potential, and suggests that investors can bridge this gap through their actions (Singh, 2013).

2-3-1 investing in clean or renewable energy

To put it simply, investment involves giving up something valuable in the present, with a known amount and quality, in order to potentially gain something of value in the future, which is often uncertain in terms of both amount and quality. Financial management techniques can help predict this uncertainty, and it is through these predictions that the risk and potential danger of investment can be assessed and analysed (Voica, et al., 2015). The clean energy industry is characterized by high start-up costs and requires substantial capital investment. However, due to market challenges and perceived risks associated with investing in this sector, it has been difficult to secure financing for renewable projects. Although the cost of renewable energy technology has decreased, financing clean energy projects remains a challenge in many parts of the world, resulting in higher initial investment costs and increased market obstacles and risks (Lee, 2015).

Countries strive for stable and ongoing economic growth and development, which leads to the increased consumption of natural resources and ultimately contributes to environmental issues. As a result, many nations recognize the necessity of employing renewable energy sources to achieve sustainable development objectives. Clean energy is critical in addressing sustainability concerns, reducing greenhouse gas emissions, and enhancing energy security. The significance of clean energy, in conjunction with the requirement for substantial financial resources and significant investments in clean energy projects, amplifies the role and importance of domestic and foreign capital in renewable energy development (Sbia, et al., 2014).

2-4 Analysis of various programs aimed at assessing sustainable energy sources

2-4-1 Evaluation of renewable energy sources in Turkey

With the rapid growth of Turkey's economy and population, there is a continuous and increasing demand for energy. However, the country does not have enough oil and gas resources to meet this demand. Fortunately, Turkey has abundant reserves of renewable energy that can be utilized to meet a portion of the total energy required. Turkey ranks second in the European Union for solar and geothermal energy and third for hydro and wind energy. Additionally, it has a significant amount of biomass energy reserves. Although three sides of the country are surrounded by the sea, tidal energy cannot be utilized. Despite the availability of significant renewable energy resources, the current share of this energy in Turkey's total energy consumption is minimal. Nevertheless, the country plans to expand its renewable energy sector and increase the share of renewable energy in the near future, as the benefits of utilizing these clean energy sources are widely recognized. A study conducted by (Kabak & Dağdeviren, 2014), titled "Prioritization of Renewable Energy Sources for Turkey," used a strategic analysis approach to thoroughly examine several aspects related to Turkey's energy, including benefits, opportunities, costs, and risks.

According to the findings of the study by (Kabak & Dağdeviren, 2014), which prioritized renewable energy sources for Turkey based on a strategic analysis of benefits, opportunities, costs, and risks, the authorities and policymakers in Turkey should prioritize hydro-power. Economic considerations were given more weight than other factors, indicating that hydro-power would bring more benefits to Turkey compared to other renewable energy options. In a separate study conducted by (Erol & Kılkış, 2012)in the Aydin region of Turkey, the focus was on the long-term planning of clean energy sources. The study concluded that investment in solar energy should be given a higher priority since it offers more benefits, and the local residents and government officials in the region were receptive to the idea. The study also suggested that the government and industries could invest in geothermal power plants as an alternative to coal power plants to reduce their concentration. Additionally, the study found that social officials have a greater influence and decision-making power in energy source policy compared to other groups. The findings from this research can be helpful for policymakers in Turkey to promote the transition from fossil fuels to renewable energy sources. According to a study conducted by (Şengül, et al., 2015), renewable energy supply systems in Turkey were ranked. After analysing various cases, the study concluded that hydroelectric power plants were given a higher priority compared to other types of power plants. This indicates that the government and related institutions should focus on investing in and building hydroelectric power plants as part of their policy to replace fossil energy sources with renewable energy sources.

2-4-2 Assessment of renewable energy sources in Malaysia

At present, approximately 90 percent of Malaysia's electricity generation is based on fossil fuels, which is generally considered an unsafe option. However, the incorporation of renewable energy sources can contribute significantly to the development of a sustainable electricity production system. It is worth noting that transitioning to a different fuel supply chain is a complex process. Malaysia's electricity industry has transitioned from a monopoly to a competitive situation, with numerous companies currently operating in the sector. Over the last three decades, energy consumption and economic growth in Malaysia have been increasing rapidly, which is a warning to planners about the necessity of replacing fossil fuels with renewable energy sources due to the limited availability of fossil fuels for electricity production. In this regard, (Ahmad & Tahar, 2014), in their study aimed to identify suitable renewable energy sources for the sustainable development of Malaysia's energy production system. The researchers evaluated four primary sources of renewable energy, including water, solar, wind, and biomass energy, and analysed the potentials and drawbacks of each source in the production of electricity. They also considered technical, economic, social, and environmental criteria for selecting a clean energy source. The results showed that the economic criterion had the most significant value, while the technical, environmental, and social criteria were less important, respectively. This indicates that decision-makers give great importance to economic factors in choosing a preferred renewable energy source. The research found that solar energy was the most suitable renewable energy source, followed by biomass, water, and wind energy. Therefore, policymakers in Malaysia could focus on formulating policies related to planning and deploying solar energy to effectively replace fossil fuels with renewable energy sources with the least negative social, environmental, and economic effects on the country.

2-4-3 Evaluation of renewable energy sources in Italy

The authors of a study (Cannemi, et al., 2014) created a decision-making model to aid policy makers in developing renewable energy sources. The model was used to analyse investment risk preferences in biomass power plant projects in Italy. Results showed that there were significant differences in the opinions of investors and government institutions regarding the four proposed options, and that the importance of criteria varied between these groups. The findings also suggested that environmental and social principles were of higher priority than other factors for experts in the construction and development of biomass power plants. Therefore, prioritizing the consideration of environmental and social principles in the development of biomass power plants and related policies would be beneficial.

2-4-4 Evaluation of renewable energy resources in Greece

The need for Greece to implement rational energy planning due to economic and environmental pressures was investigated by (Mourmouris & Potolias, 2013)in their study titled "Providing a Multi-Criteria Methodology for Energy Planning and Development of Renewable Energy Resources at the Regional Level in Thasos Island in Greece". According to the results, wind energy is given a higher priority than other renewable energy sources. Additionally, the multi-criteria evaluation method revealed that combined wind-biomass energy has a higher priority compared to the other two combinations.

2-4-5 Evaluation of renewable energy sources in Spain

Spain's energy system is characterized by its reliance on energy imports. To address this issue, the Spanish government proposed a renewable energy development plan in 2005. The plan focused on various renewable energy sources, including wind, hydroelectricity, and thermos solar, solar thermoelectric, photovoltaic, biomass, bio-gas, and bio-fuel. The main objective of this plan was to meet 12% of the country's current energy needs through renewable sources. (San Cristóbal, 2011) Conducted a study on multi-criteria decision-making for selecting renewable energy projects in Spain. The research aimed to identify and prioritize renewable energy sources based on expert opinions and literature review. A hierarchical analysis method was used to evaluate the importance of each criterion. The results indicated that a biomass power plant combusted with conventional power plants was the second-best option after wind power plant and the third-best option after solar thermoelectric power plant. Production power was the most crucial criterion, followed by the amount of carbon dioxide removed from the environment. The biomass power plant showed the highest priority in these two criteria compared to wind and solar thermoelectric power plants. While solar thermoelectric power plants require significant capital and investment, biomass power plants have the highest priority.

2-5 History of research and studies

In their study titled "Investigating the Interrelationship between Clean Energies, Domestic and Foreign Capital Development, Economic Growth, and Environmental Quality in a Group of Developing Countries during 1995-2018," (Daei-Karimzadeh, et al., 2021). Used the system of simultaneous equations and the method of generalized moments to examine the relationships between these variables. The study conducted by (Daei-Karimzadeh, et al., 2021) aimed to investigate the relationship between clean energy, economic growth, domestic and foreign capital development, and environmental quality in a group of developing countries during the period of 1995-2018. Three different indicators were used to estimate the effect of domestic and foreign capital development, which include foreign direct investment, stock markets, and private sector credits. The findings reveal that a one to two percent increase in clean energy, a four percent increase in carbon dioxide emissions, and a one percent increase in foreign direct investment have led to economic growth in the studied countries. However, economic growth has also increased the consumption of clean energy by an average of 11% while increasing carbon dioxide emissions. Clean energy projects have low efficiency and require high financial provisions compared to other energy supply projects. Therefore, the lack of development of financial institutions and their limited access to funds needed to finance clean energy projects in developing countries have hindered investment in such projects to reduce carbon dioxide emissions.

(Phong & Sarkodie, 2020)Conducted a study titled "Dynamic linkage between renewable and conventional energy use, environmental quality and economic growth: Evidence from Emerging Market and Developing Economies during 1990-2014 using panel data". The study found that renewable energies have a positive impact on economic growth, and there is a reciprocal relationship between economic growth and environmental quality.

The research conducted by (Paramati, et al., 2017) examined the financing of clean energy projects through domestic and foreign capital in European Union countries and member countries of the Organization for Economic Cooperation and Development from 1993 to 2012 using the panel aggregation method. Domestic capital was measured by stock market development and credits allocated to the private sector, while foreign direct investment was used as an indicator of foreign capital. The findings indicate that the development of stock markets and foreign direct investment played a significant role in the expansion of clean energy, and that clean energy has had a positive impact on economic growth.

The research by (Ahmad & Tahar, 2014) aimed to use the hierarchical analysis process to select renewable energy sources for sustainable development of the energy production system in Malaysia. The study focused on two issues; first, evaluating the potential of various renewable resources, and secondly, developing an evaluation model for ranking them. The study considered four main sources, including water, solar, wind, and biomass energy, and discussed the potentials and shortcomings of each in electricity production. The researchers developed an evaluation model based on a multi-criteria decision-making approach, which included four main criteria and 12 sub-criteria, namely technical, economic, social, and environmental criteria. The study concluded that renewable energy sources had adequate potential for developing a sustainable electricity system. The researchers used the hierarchical classification method to determine the relative weights of the main criteria by drawing and analysing the problem model based on the method's steps.

(Cannemi, et al., 2014)Conducted research on decision-making modelling as a supportive tool for policymakers in the development of renewable energy. They focused on investment risk preferences in biomass power plant projects in Italy and aimed to enhance the decision-making process for policy makers in the field of renewable energy development.

The study conducted by (San Cristóbal, 2011)) aimed to determine the renewable energy sources with higher priority for investment in Spain, using the VIKOR method for multi-criteria decision-making. The criteria were extracted from research literature and evaluated by experts. The results revealed the most profitable areas for investment and the factors that affect investment decisions in this field.

3 Research methodology

3-1 Introduction

The process of research involves a structured approach to explore and define the unknown aspects and features of a particular situation. Methodology is fundamental to every scientific field, and the accuracy and importance of scientific laws are determined by the methodology employed. Failure to use proper scientific methodology would result in findings that cannot be generalized, and the researcher's objectives cannot be accomplished. Descartes believes that the scientific method is the way to discover truth in science (Khaki, 2020). The foundation of scientific investigation is the elucidation of the correlation between variables. Two primary approaches are employed to establish relationships, which have notable distinctions. The descriptive method is one of these approaches and encompasses a range of techniques aimed at outlining the characteristics or occurrences of the topic under scrutiny. Descriptive research is implemented solely to gain a better understanding of the current circumstances or to facilitate decision-making (Sarmad, et al., 2021). This section of the chapter provides an overview of the research approach adopted for studying the community. The discussion covers the sample selection process, sampling methodology, and the reliability of questionnaires, as well as the utilization of the fuzzy Delphi and multi-criteria decision-making (AHP) methods.

3-2 Research Methodology

This study can be classified as a descriptive-observational investigation in terms of its objectives, and an applied research that utilizes mathematical principles to generate results. The fuzzy Delphi method and the analytical hierarchy process (AHP) were employed to identify and assess the factors that influence investment prospects in clean energy across the European Union. Figure 3-1 depicts the proposed framework for the study, which includes several steps.

The research process comprises three stages;

The first phase involves identifying the factors that influence investment opportunities in clean energy in the European Union by analysing existing research literature and consulting with specialists and experts.

In the second stage, a hierarchy is constructed, and a pairwise comparison matrix is created to determine the influential factors. The analytical hierarchy process (AHP) method is utilized to assess the compatibility rate and calculate the effectiveness of each factor.

The third stage entails comparing the findings of this study with previous research and recommending suitable solutions and suggestions.

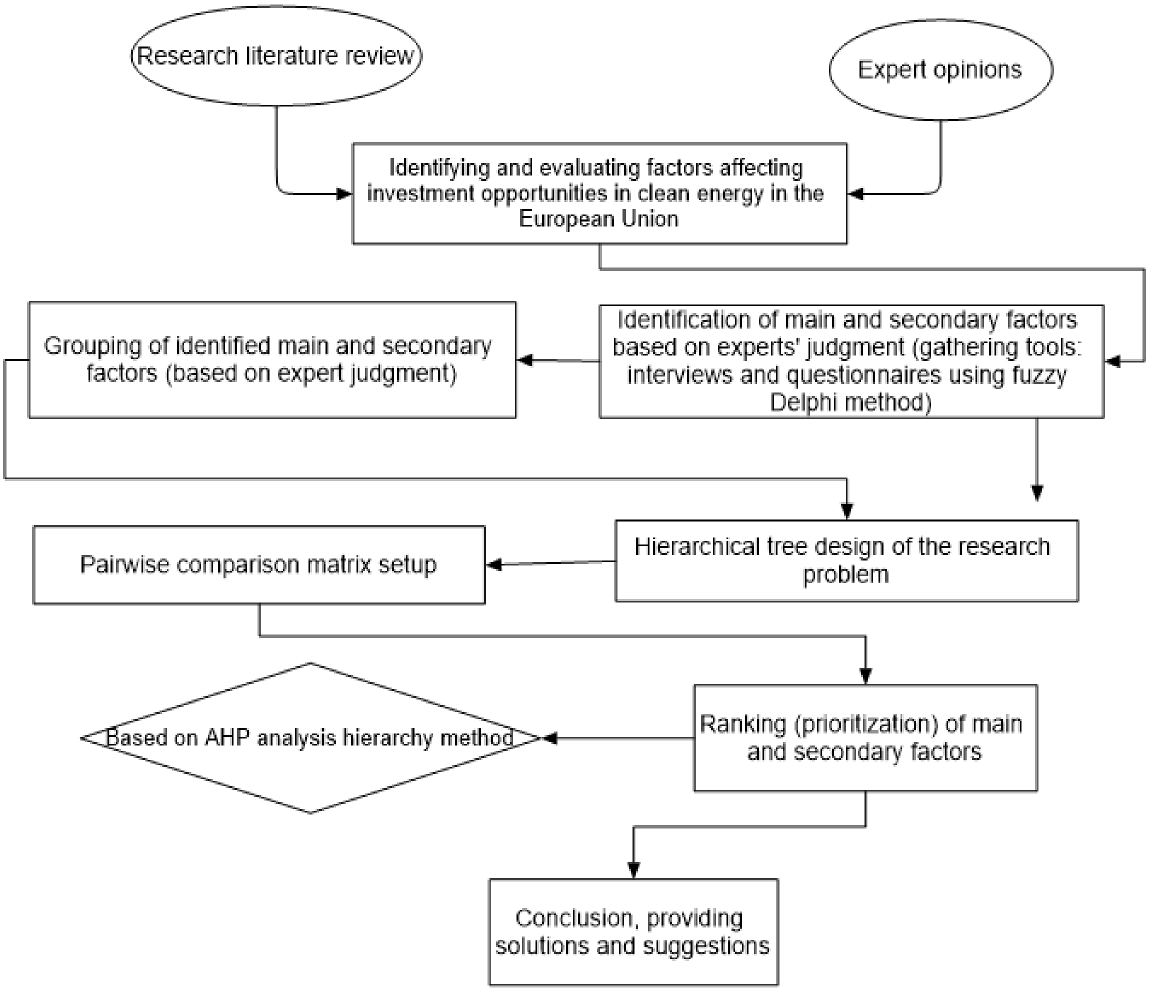

Figure 1-3. Research steps

Source: Author's own construction

3-3 Statistical community and sampling volume

A statistical population refers to all individuals and entities that share one or more common characteristics within a specific geographic region or scale, whether it be global or regional (Hafez Nia, 2019). In this study, the statistical population of interest comprises researchers, investors, active managers, senior executives, and experts who operate within the energy supply sector in European Union member countries. Instead of a traditional sample size, the research problem-solving team solicits opinions from the entire population. For this research, the available sampling method is used. The decision team for this study consists of 20 experts in the field.

3-4 Data collection methods and tools

The research employed a descriptive survey method to gather information and data. This involved obtaining the perspectives of all researchers, investors, active managers, senior executives, and experts who operate within the energy supply sector of EU member countries. The necessary statistics and data are collected for each of the relevant factors, and their ranking is subsequently calculated. The methods utilized in this research include the following:

Two methods were employed to gather data for this research:

1) Library Method: The scientific concepts and topics related to the research problem were gathered from various library sources in English, Farsi, and other languages.
2) Survey Method: Two questionnaires were utilized in this study, one in fuzzy Delphi format and the other in AHP format. The questionnaires were designed to determine the importance coefficient of the main and secondary factors influencing investment opportunities in clean energy in the European Union. A hierarchical questionnaire in AHP format, which included a nine-point scale and pairwise comparisons, was also administered to assess the compatibility of the indicators. The questionnaire was created based on the hierarchical tree of the problem under study. The formula used to determine the number of pairwise comparisons in the questionnaire was $\frac{n(n-1)}{2}$.

3-5 Reliability and validity of data collection tools

When it comes to hierarchical analysis or AHP method questionnaires, the concept of reliability is not applicable, unlike the conventional SPSS software questionnaires, which typically have six options on the Likert scale. This also applies to fuzzy questionnaires, such as ANP and AHP. In other words, there is no reliability index for the pairwise comparison questionnaire, such as Cronbach's alpha reliability coefficient. Instead, the concept of inconsistency rate is used, which will be discussed later. The validity of the questionnaire, on the other hand, refers to how accurately it measures the subject and characteristics that are being considered. The AHP method questionnaire is approved by subject matter experts, so its validity is established, and content validity is used to address the issue of validity.

3-6 Data analysis method

3-6-1 the fuzzy Delphi method

The initial step of this study involved a thorough investigation of relevant literature and library sources to gain a comprehensive understanding of concepts, extract significant and influential factors, and formulate a hierarchy through group decision-making methods such as the Delphi method. The opinions of the research team, consisting of managers, experts, and specialists, were also sought in this regard. Moreover, to identify the primary dimensions and develop the initial model, a series of sessions were conducted, which involved previous research and consultations with experts and specialists.

The Delphi technique is a structured process used for predicting and aiding decision-making through multiple rounds of surveys, gathering information, and achieving group consensus. Unlike most surveys that aim to answer the question "What is?" Delphi is used to answer "What can?" or "What should be?" However, the main weakness of this technique is the lack of a theoretical framework, which has led some to refer to it as a technique and others to use terms such as approach, study, survey, poll, method, or consensus study to describe Delphi studies (Ahmadi, et al., 2008).

The Delphi method is based on the belief that the opinions of experts in a specific field are the most reliable for predicting the future. Unlike other survey methods, the validity of the Delphi method depends on the scientific validity of the participating experts, not on the number of participants. Typically, the number of participants ranges from 5 to 22 people, depending on how the research is designed. The experts form a panel, and communication among them is facilitated by a chairperson or a supervisor. The participants' opinions, predictions, and tendencies are kept anonymous, and the information is published without revealing their identities. One of the main benefits of this method is that it can help gain consensus in opposing groups, leading to more innovative ideas and expanded knowledge. Additionally, the Delphi method allows for unbiased views, honest expressions of ideas and opinions, and freedom from any pressure or influence from certain individuals. Feedback between rounds also stimulates new ideas and enhances participants' training.

The Delphi method is a systematic and analytical approach that avoids wasting time and energy on irrelevant or biased decisions (Ahmadi, et al., 2008). It facilitates group communication and can effectively solve complex problems through multiple interactions between experts.

Compared to other methods like navigation, the Delphi method has a high level of richness (Fakoor saghih, et al., 2014). The Delphi method is typically employed by researchers when it is important to gather judgments and opinions from participants. To do this, a series of questionnaires are utilized with regulated feedback (Rowe, et al., 1991). The primary objective of utilizing questionnaires and obtaining feedback from experts is to decrease the wide range of opinions (Hillier & Lieberman, 2014).To achieve this goal, Delphi researchers use a series of questionnaires that provide controlled feedback. The fuzzy Delphi method is then used to select a logical number of decision criteria that are presented in a hierarchical framework, based on a comprehensive resource review. This method conceptualizes the relevant criteria by utilizing the opinions and views of experts. The implementation steps of the fuzzy Delphi method are outlined as follows (H.I. Lee, et al., 2010).

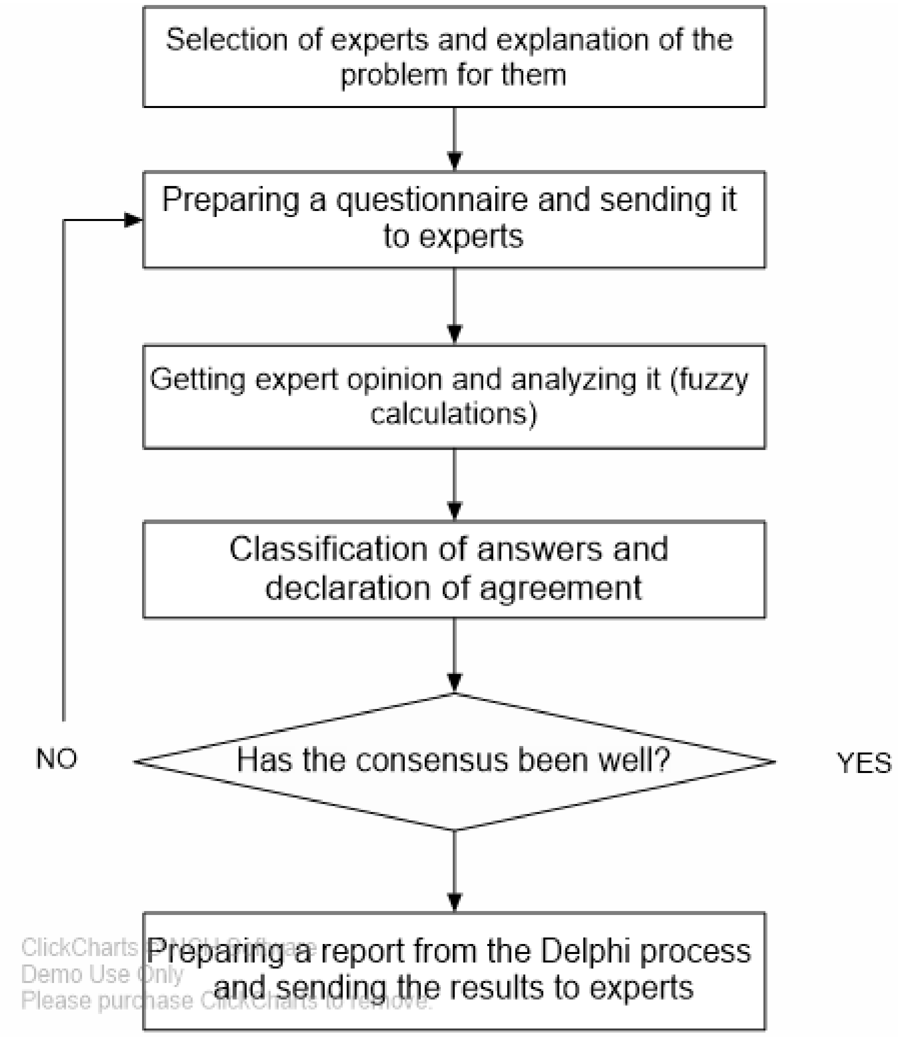

Figure 2-3. Algorithm for implementing fuzzy Delphi method

Source: Author's own construction

1- Selecting experts and presenting the problem to them.
2- Creating a questionnaire using a 10-point scale for pessimistic and optimistic values (1-10) and distributing it to the experts.
3- Gathering the experts' opinions and using fuzzy calculations to analyse the degree of importance of sub-criteria and research variable indices.
4- Categorizing the responses and announcing the consensus.
5- Evaluating the consensus.
6- Generating a report on the fuzzy Delphi process and selecting the most suitable criteria based on the threshold value (significant average value) and sharing the results with the experts.

Step 1-1: Using a questionnaire and organizing an expert panel to express the conservative value (minimum) and optimistic value (maximum). The importance of each criterion in the set of possible criteria S in the range of 1 to 10. A score is shown as $\boldsymbol{C_{ik}} = (\boldsymbol{L_{ik}}, \boldsymbol{U_{ik}}),\ \boldsymbol{i} \in \boldsymbol{S}$, where $\boldsymbol{L_{ik}}$ and $\boldsymbol{U_{ik}}$ are the conservative index and the optimistic index of criterion$\boldsymbol{i}$, respectively, which are rated by $\boldsymbol{k}$ experts.

Step 1-2: Organizing the opinions of experts collected from questionnaires and determining the TFN for the most conservative index$\boldsymbol{C_i} = (\boldsymbol{LC_i}, \boldsymbol{MC_i}, \boldsymbol{UC_i})$and the most optimistic index$\boldsymbol{O_i} = (\boldsymbol{LO_i}, \boldsymbol{MO_i}, \boldsymbol{UO_i})$for each criterion$\boldsymbol{i}$.Use the conservative index$\boldsymbol{C_i} = (\boldsymbol{LC_i}, \boldsymbol{MC_i}, \boldsymbol{UC_i})$because it represents the least conservative value of the experts:

$$LC_i = \min(L_{ik}). \quad (1)$$

The variable $\boldsymbol{MC_i}$ represents the geometric mean value of the most cautious experts for criterion$\boldsymbol{i}$. This is derived from the second equation.

$$MC_i = (L_{i1} \times L_{i2} \times \cdots \times L_{ik})^{\frac{1}{k}} \quad (2)$$

$\boldsymbol{UC_i}$ Represents the maximum conservative value of the experts:

$$UC_i = \max(L_{ik}). \quad (3)$$

Likewise, the minimum ($\boldsymbol{LO_i}$), geometric mean ($\boldsymbol{MO_i}$) and maximum ($\boldsymbol{UO_i}$) of the most optimistic group for criterion $\boldsymbol{i}$ can be obtained.

Step 1-3: TFN calculation for the most conservative index $\boldsymbol{C_i} = (\boldsymbol{LC_i}, \boldsymbol{MC_i}, \boldsymbol{UC_i})$ and the most optimistic index $\boldsymbol{O_i} = (\boldsymbol{LO_i}, \boldsymbol{MO_i}, \boldsymbol{UO_i})$ for the remaining strategies$\boldsymbol{A_i}, \boldsymbol{i} \in \boldsymbol{S}$.

Step 1-4: Examining the homogeneity of experts' opinions and calculating the significance value, $\boldsymbol{G_i}$ for each criterion. Grey area (Hsiao, 2006), (H.I. Lee, et al., 2010), the overlapping part of $\boldsymbol{C_i}$ and $\boldsymbol{O_i}$ in Figure 2 is used to check the consensus of experts in each criterion and calculate the significance value of the total$\boldsymbol{G_i}$.

If the TFN pair does not overlap i.e.($\boldsymbol{UC_i} \leq \boldsymbol{LO_i}$) and there is no grey area, the expert's opinion about criterion $\boldsymbol{i}$ has reached a consensus level and the significant value of the consensus is calculated as follows:

$$G_i = \frac{MC_i + MO_i}{2}. \tag{4}$$

If there is overlap i.e.($\boldsymbol{UC_i} > \boldsymbol{LO_i}$) and the distance value of the grey area $\boldsymbol{G_i}$ is equal to $\boldsymbol{UC_i} - \boldsymbol{LO_i}$ and $\boldsymbol{G_i}$ is less than the distance value of $\boldsymbol{C_i}$ and$\boldsymbol{O_i}(\boldsymbol{d_i} = \boldsymbol{MO_i} - \boldsymbol{MC_i})$, i.e.$\boldsymbol{G_i} > \boldsymbol{LO_i}$, then the significant value of G is according to the tangent point $P(\boldsymbol{\mu_L}\sim, \boldsymbol{\mu_U}\sim)$of the grey area in Figure 2 Determined. The significant value for each criterion is obtained by equations 5and 6.

$$G_i = \max\left\{ \int_P \left[\min\left(\mu_{\tilde{L}}(p), \mu_{\tilde{U}}(p) \right) dp \right] \right\} \tag{5}$$

$$G_i = \frac{UC_i \times MO_i - LO_i \times MC_i}{(UC_i - MC_i) + (MO_i - LO_i)}. \tag{6}$$

If there is a grey area and $\boldsymbol{G_i} > \boldsymbol{d_i}$ then, there will be a huge difference between the opinions of experts. Repeat steps 1.1 to 4.1 until convergence is achieved (Ishikawa, et al., 1993).

Step 1-5: Extract criteria from the selected list. The significant value is compared with the threshold value of T, which is obtained subjectively by experts based on the geometric mean of all significant consensus values (Ishikawa, et al., 1993), (Hsiao, 2006), (H.I. Lee, et al., 2010). If$\boldsymbol{G_i} > \boldsymbol{T}$, Criterion $\boldsymbol{i}$ is selected for further analysis. The operational process of these five steps can be examined in the fourth chapter.

3-6-2 Analysis Hierarchy Method (AHP)

The current study is using multi-criteria decision-making models that are based on mathematical reasoning. Therefore, some of the models used in this study will be explained in detail. Additionally, the data analysis section of this study utilized specific software, which is described below.

3-6-2-1 An overview of multi-criteria decision making

Making a decision involves selecting the optimal choice among various options. However, many decision-making problems are complex due to the presence of multiple criteria, which can make it challenging to have confidence in the results obtained from various decision-making solutions. Therefore, in many cases, the decision-maker aims to achieve multiple goals simultaneously in order to select the best course of action (Zeleny, 1982).

3-6-2-2 multi-criteria decision-making (MCDM)

Mathematicians and industry practitioners have been concentrating on optimization and decision-making models since the industrial movement, particularly since the Second World War. Classic optimization models have a primary emphasis on having a measurement criterion or objective function (Asgharpour , 2022), such as:

$$
\begin{aligned}
&Max\ \ or\ \ Min\ F(X)=\left\{f_1(X),....,f_k(X)\right\} \qquad ;F:E^n\rightarrow E^k\\
&s.t:\\
&g_i(X)\begin{bmatrix}\leq\\ \geq\\ \equiv\end{bmatrix}0 \qquad ;i=1,....,m \quad ;E^n\rightarrow E^k\\
&X=(x_1,.....,x_n)
\end{aligned}
$$

The traditional optimization models usually emphasize having a measurement criterion or an objective function, which can be linear, non-linear, or mixed. However, in many decision-making problems, a single criterion or goal cannot represent all aspects of the problem. Therefore, when dealing with multiple criteria or goals, the process of modelling and decision-making is referred to as Multiple Criteria Decision Making (MCDM).

This model involves quantitative and qualitative criteria with different units and scales, including economic and non-economic factors. Several methods and techniques have been developed to solve such models to determine the best option or optimal point. Multiple criteria decision-making models are widely used in various fields such as management, strategic planning, industrial planning, transportation, telecommunications, computer networks, natural resource management, and energy resource development. In these disciplines, decision-making problems are modelled with multiple criteria, and experts in decision-making models help decision-makers make informed decisions, which can save or generate millions of dollars. Due to the wide range of such issues, multi-criteria decision models are divided into two main categories:

1-Multi-objective decision making (MODM).

2-Multi-criteria decision making (MADM).

The fundamental distinction between the two groups of decision-making models lies in the answer space. In multi-objective decision-making, the answer space is continuous and the options are not predetermined. In this group, mathematical programming is used to design and determine the optimal answer and option for a multi-objective model. In contrast, the answer space in multi-criteria decision-making is discrete. However, there are exceptions to this rule, such as programming correct variables with multiple goals. This distinction is helpful in better comprehending the content being discussed.

Multi-criteria decision-making is used when there are several predetermined options, and the decision-maker has to choose the best one. On the other hand, multi-objective decision-making involves finding the optimal solution within a limited decision-making space. Typically, multi-objective models are employed to design the best solution, whereas multi-criteria models are utilized to select the optimal option.

3-6-2-3 Multi-objective decision making (MODM)

The multi-objective model is formulated as follows:

$$
\begin{aligned}
&Max \;\; or \;\; Min \; F(X) = \{f_1(X),....,f_k(X)\} \qquad ; F : E^n \to E^k \\
&s.t: \\
&g_i(X) \begin{bmatrix} \leq \\ \geq \\ \equiv \end{bmatrix} 0 \qquad ; i = 1,....,m \quad ; E^n \to E^k \\
&X = (x_1,.....,x_n)
\end{aligned}
$$

Design models are created to optimize the overall utility function for decision makers. However, in these models, each objective may have a different measurement scale and cannot be easily combined or added together with other objectives.

This utility function is objectively calculated and optimized in some evaluation methods, and in others it is implicitly investigated and optimized.

3-6-2-4 Multi-criteria decision making (MADM)

The multi-indicator model is formulated as the following decision matrix:

Decision matrix D

Index / option	C1	C2	…	Cn
A1	r11	r12	…	r11
A2	r21	r22	…	r2n
⋮	⋮	⋮	⋮	⋮
An	rm1	rm2	…	rmn

Where in the above decision matrix:

$\boldsymbol{A_i}$: Option with alternative i is already known

$\boldsymbol{C_J}$: The index or characteristic j

$\boldsymbol{r_{ij}}$: The value of the j index for the i option

3-6-2-5 Comparison between MADM, MODM models

The MODM approach aims to create the preferred option for the decision-maker, while the MADM approach focuses on selecting the most desirable option from a pre-existing set of options. Table (1-3) illustrates the dissimilarities between multi-objective decision-making models (MODM) and multi-criteria decision-making models (MADM). There are several differences between these two models in various aspects, which are elaborated.

Table 1-3. Comparison between MADM and MODM models

Source: (Azar, 2016)

MCDM / Different things	MADM	MODM
Criteria	Indicators	Goals
Goals	are explicitly stated	are implicitly expressed They are poorly expressed
Indicators	are explicitly stated	are implicitly expressed
Limitations	Unknown are included in the criteria	quite clear
Options	Limited number, specified	Unlimited number They become known as a result of a process
Interaction with the decision maker	Low	high
How to use	In selection and evaluation	Designing

3-6-2-6 examining the available models in MADM

In terms of their application method, MADM models are generally categorized into two types: compensatory and non-compensatory models. This division is illustrated in Figure (3-3).

- Compensation models

Compensatory models are a type of MADM models where a trade-off between indicators occurs. This means that a change in one indicator can be offset by a change in another indicator, but in the opposite direction. Some of the methods used in compensatory models include the Simple Additive Weighting method, Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), Elimination ET Choice Translating Reality method (ELECTRE), Linear Assignment (LA), and Analytic Hierarchy Process (AHP).

- Non-compensatory models

Non-compensatory models refer to MADM models where there is no trade-off between indicators, which means that the weakness in one index cannot be compensated by the advantage in another index. In these models, each index is evaluated separately from other indices to determine the competing options. These models have the advantage of being simple and aligned with the decision-makers behaviour and limitations. Some of these methods do not require information from the decision-maker. Examples of non-compensatory models include the dominance method, lexicography method, elimination, maxi min strategy, maxi-max, Conjunctive satisfying method, and Disjunctive satisfying method.

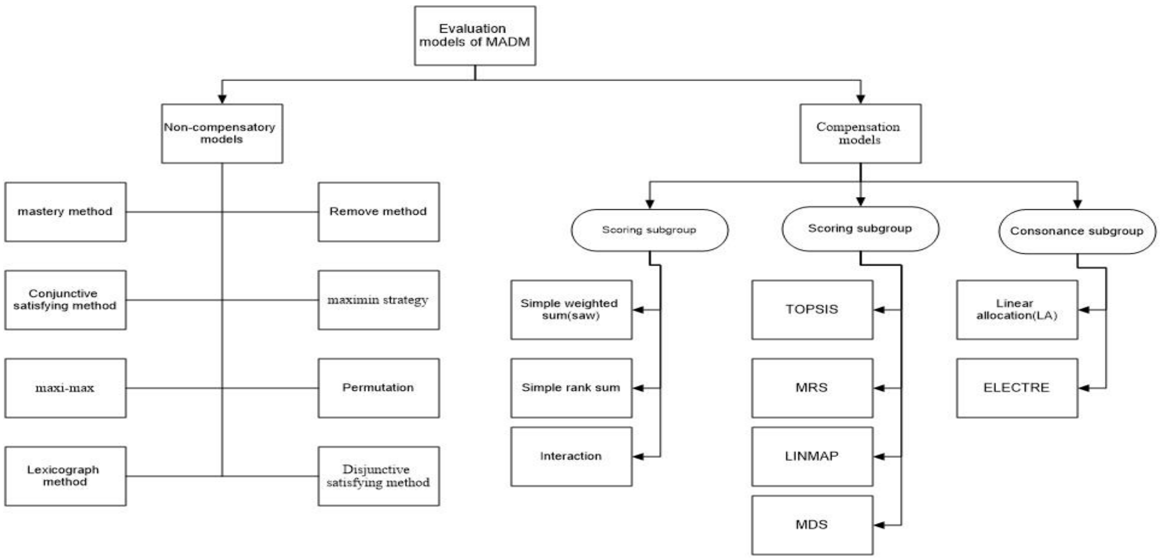

Figure 3-3. Decision making models in MADM. Source: (Azar, 2016)

3-6-2-7 The MADM models used in this study

- Analysis Hierarchy Process (AHP)

The Analytical Hierarchy Process (AHP) is a MADM method that can be utilized for decision-making and selecting an option from various options, based on predefined indicators set by the decision maker. AHP aims to reflect natural human behaviour and thinking in decision-making. The approach starts by creating a decision hierarchy tree that represents the compared factors and competing options in the decision process. Then, pairwise comparisons are conducted between the factors, and the outcome of these comparisons determines the importance of each factor in relation to the competing options. Finally, the AHP method combines the matrices generated from pairwise comparisons to obtain the optimal decision. The implementation of AHP involves several steps (Asgharpour , 2022).

Step 1: **Modelling (building a decision hierarchy tree)**

The decision-making strategy is visually presented in the form of a hierarchical tree. The top level of this tree represents the ultimate goal of the decision-making process. The middle levels of the tree represent the criteria that influence the decision, while the bottom level shows the available options to choose from. Selecting the right criteria and factors that have a significant impact on the decision-making goal is crucial in this step.

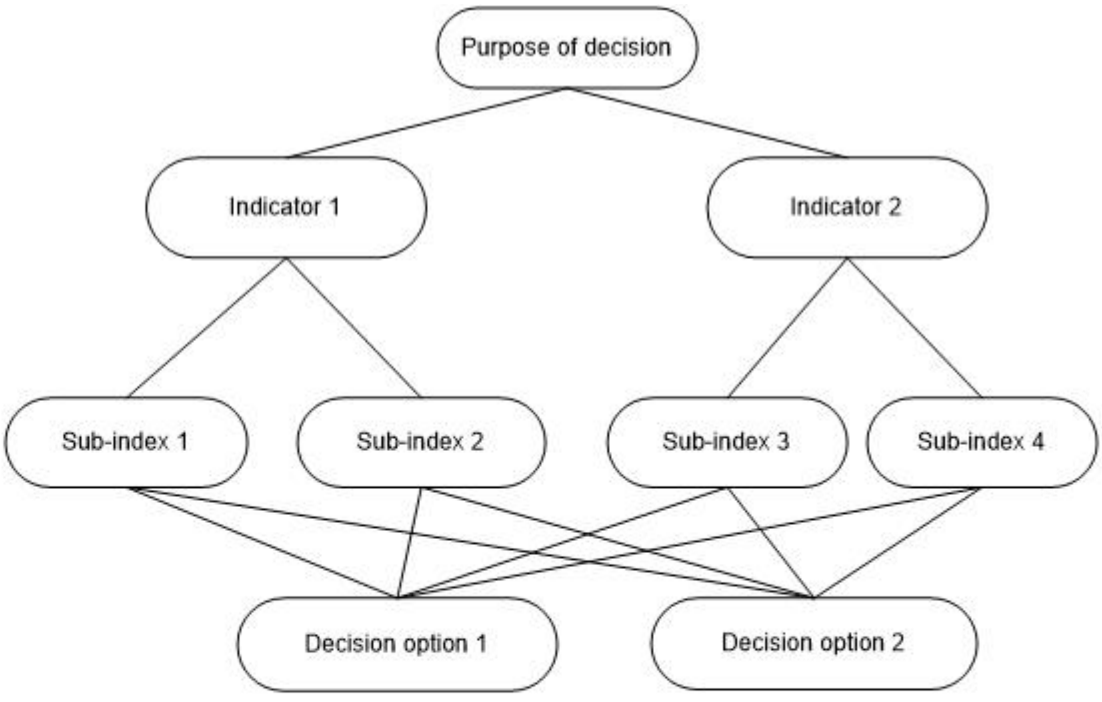

Figure 4-3. Hierarchical tree display. Source: Author's own construction

Step 2: **Preference judgment (making pairwise comparisons)**

Once the decision problem is hierarchically modelled, the decision-maker must assess the elements (indicators or options) of each level in relation to the corresponding element at a higher level and determine their weights. This is accomplished using a set of matrices that compare the relative importance or priority of the indicators to one another, and measure the final decision based on the indicators in relation to other alternatives. The comparison of decision elements is conducted through pairwise comparison, which assigns numerical values to express the preference or importance between two elements. Generally, the following scale table is utilized for this purpose.

Table 2-3.Valuation of indicators relative to each other. Source: (Mehregan, 2021)

Preferred value	Comparison status of ***i*** with respect to j	Explanation
1	Equal importance or no preference	Option or index ***i*** is at the same level of importance as compared to j, or they are not preferred to each other.
3	Relatively important	Option or indicator ***i*** is slightly more important than j.
5	important	Experiences and evaluations show that ***i*** is more important than j.
7	more important	The option or indicator ***i*** has a high priority and is much more important than j.
9	infinitely important	The option or indicator ***i*** is extremely important compared to j to the extent that it is not comparable to j.
2 , 4, 6 , 8	Intermediate values	It shows intermediate values between preferred values. For example, 8 indicates more importance than 7 for***i***. But not to the extent that it is not comparable to j at all.

The result of each person's comparison can be shown in a table called a pairwise comparison matrix. It is clear that the main diameter of this matrix is one. After the comparative tables of all people have been prepared, these theories should be converted into a single opinion so that the optimal decision can be made based on that. The most suitable method for this task is to use the geometric mean. For this purpose, suppose $a^{(k)}_{ij}$ is the component related to the kth person for the comparison of agent $\boldsymbol{i}$ with respect to j. In this case, the geometric mean is calculated as equation (1).

$$\overline{a_{ij}} = \left[\prod_{K=1}^{N} a^{(k)}_{ij} \right]^{\frac{1}{N}}$$

Equation 1

Step 3: **Calculation of relative weights from group pairwise comparison tables**

The next step in AHP is to perform the necessary calculations to determine the priority of each of the decision elements using the information of the pairwise comparison matrices as follows.

3-1: Calculate the sum of the numbers of each column of the matrix of paired comparisons, then divide each element of the column by the sum of the numbers in that column. The new matrix obtained in this way is called "normalized comparison matrix". This step is calculated according to equation (2).

$$r_{ij} = \frac{\overline{a_{ij}}}{\sum_{i=1}^{n} \overline{a_{ij}}}$$

Equation 2

The variable $\boldsymbol{r_{ij}}$represents the normalized value of the component.

3-2: Find the average of the numbers in each row of the normalized comparison matrix. This average indicates the relative weight of the decision elements corresponding to the rows of the matrix. This step is calculated according to equation (3).

$$W_i = \frac{\sum_{i=1}^{n} w_{ij}}{n} \ , j = 1,2,\dots,n \qquad , \sum_{i=1}^{n} W_i = 1$$

Equation 3

3-6-2-8 The consistency rate of the hierarchical analysis method

The reliability of the priorities obtained from the presented method is questionable, and to address this issue, the consistency ratio is employed. The consistency ratio is a measure of the consistency of the comparisons made. Typically, if the consistency ratio is CR≤0.1, the judgment can be considered dependable, and the weights can be considered reliable.

In order to calculate the consistency ratio, the matrix of pairwise comparisons is multiplied by the weight vector of each index (Saaty, 1980). The first step in applying the hierarchical analysis technique is to compute the consistency ratio of the matrix of pairwise comparisons based on the employees' opinions. In this study, the group hierarchical analysis technique was implemented using the Expert Choice 2000 software, which receives the questionnaires and integrates them to rank the criteria and report the overall ranking and consistency ratio. The acceptable consistency ratio is typically less than 0.1, which was also the case in this study. The respondents were asked to compare the influencing factors pairwise. After creating the hierarchical tree, the next step was to evaluate the elements using pairwise comparisons. Pairwise comparison is a process of comparing the importance or plausibility of two elements compared to the higher level element.

1- Calculation of weighted sum vector (WSV): In this part, the main values of the group table comparisons are multiplied in the priority of the variables, and finally the sum of each line is obtained.

$$WSV = A \times W$$

2- The compatibility vector (CV) is derived by dividing each component of the Weighted Sum Vector (WSV) by the corresponding variable priority.
3- The λ_{max} value is determined as the average of the compatibility vector.
4- The consistency index (CI) is calculated based on Equation 4 for individual comparisons and Equation 5 for group comparisons, as proposed by (Saaty, 1980).

$$C.I = \frac{\lambda_{\max} - n}{n-1}$$

Equation 4

(n, represents the number of competing options with the number of variables in question)

$$I.I = \frac{\lambda_{\max} - n}{n}$$

Equation 5

5- Calculating the Inconsistency Rate (I.R): The compatibility rate based on (Equation 6) is:

$$I.R = \frac{\text{I.I}}{\text{I.R.I}}$$

Equation 6

I. R. I Represents the random index value.

This index is extracted from Table 3-3 prepared by (Saaty, 1980):

Table 3-3. Random Index (I.R.I)

Source: (Saaty, 1980)

N	1	2	3	4	5	6	7	8	9	10
I.R.I	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.51

3-6-3 the software used in this research

In this study, the researchers utilized the following software based on the nature of the research:

1- Team Expert Choice software: This software is specially designed for group decision-making models. It allows the creation of pairwise comparison matrices among individuals, the combination of matrices from different people, and the conversion of the combined matrix into a single matrix through the geometric mean of individual matrix elements. Additionally, this software can calculate the compatibility rate of each paired matrix using the IR method.

2- Excel: Due to its computational capabilities, Excel was used for calculations involving decision-making matrices in multi-indicator decision-making methods.

3- SPSS: During the phase of identifying the factors using the fuzzy Delphi method, the researchers used SPSS software.

4 Statistical Analysis

Checking the accuracy of research questions is particularly important, and data analysis plays a crucial role in achieving this goal. Nowadays, in most studies that rely on data collected from research subjects, data analysis is regarded as one of the key and essential components of the research process. Raw data are processed using statistical software and transformed into valuable information that is useful to researchers. In this chapter, we will use data obtained from distributed questionnaires and analyse it using common statistical software. The results will then be used to investigate each of the research questions, and the outcomes of the data analysis will be presented in the form of tables and charts.

4-1 Identification of factors using fuzzy Delphi method

To identify the factors that affect investment opportunities in clean energy in the European Union, a questionnaire was used to collect fundamental information and data. Delphi meetings were also conducted with 20 experts and specialists in the field to gather insights. These meetings, combined with a review of relevant research literature, resulted in the identification of several key factors that are further discussed in the subsequent stages of the factor identification process. Based on the opinions of 20 experts, the importance of the criteria and indicators was assessed using a scoring system ranging from 1 to 10 for pessimistic and optimistic perspectives. The scores for both perspectives are presented in the table below.

Table 1-4.Identifying the main factors based on the fuzzy Delphi method

Source: Author’s own construction

Dimensions of the main factors	Pessimistic amount		Optimistic amount		Optimistic amount	Geometric average	Significant amount	Rank
	lowest	highest	lowest	highest	J_m^i	u_m^i		
Economic and financial	2	9	5	9	5.38	6.35	9.33	3
Infrastructure and regional	2	10	4	10	5.85	6.83	8.11	4
Supportive	4	9	6	10	6.15	6.48	7.79	5
Environmental and social	1	9	6	10	4.77	6.31	9.38	2
Legal and administrative	1	9	6	10	5.17	6.76	9.96	1
Political and government	1	8	4	10	4.01	6.07	5.53	6
Scientific and educational	1	5	2	6	2.14	4.21	3.11	7

Threshold=7.6*

Based on the mean value of the significant column, which is 7.6, it can be inferred that the "scientific and educational" and "political and governmental" factors have less significance compared to the other factors among the seven factors identified. Their scores fall below the threshold of 7.6, indicating that they should be eliminated from further consideration. Therefore, the remaining factors with scores above the threshold are considered more significant and will be selected for further analysis.

Table 2-4. Sub-factors of the economic and financial dimension

Source: Author's own construction

Dimensions of the main factors	**Pessimistic amount**		**Optimistic amount**		**Optimistic amount**	**Geometric mean**	**Significant amount**	**Rank**
	lowest	**highest**	**lowest**	**highest**	J_m^i	u_m^i		
Appropriate banking facilities	3	8	8	10	5.23	8.73	9.85	4
Access to capital and liquidity	3	9	7	9	5.43	8.12	12.12	1
Low rates of clean energy and energy subsidies	1	9	5	10	3.3	7.34	6.94	5
Economic incentives	2	9	6	9	5.32	8.15	40.76	2
Support of banks and financial institutions	4	9	7	10	6.59	8.41	10.74	3

Threshold=10.08*

The significant column in the data was analysed, and its mean value was calculated to be 10.08. As a result, it can be concluded that the sub-factor "low rate of clean energy and energy subsidy" is less significant than the other sub-factors, as its score falls below the threshold of 10.08. Therefore, this sub-factor will be removed from further analysis. The remaining sub-factors will be considered, as their significance values are higher than the threshold.

Table 3-4. Sub-factors of infrastructure and regional dimension

Source: Author's own construction

Dimensions of the main factors	Pessimistic amount		Optimistic amount		Optimistic amount	Geometric mean	Significant amount	Rank
	lowest	highest	lowest	highest	J_m^i	u_m^i		
The existence of land required for the production of clean energy	2	8	5	10	4.82	7.28	6.51	4
Easy access to industrial and urban areas	3	7	7	10	4.78	8.51	6.72	3
Appropriateness of the existing infrastructure	2	8	7	10	4.09	8.49	8.07	1
Access to technology and technical knowledge	1	6	2	8	2.79	4.69	3.21	5
Skilled and specialized workforce	4	7	7	9	5.28	7.82	7.4	2

Threshold=6.38*

The mean of the significant value column was calculated to be 6.38, which serves as the threshold limit for determining the significance of the factors. Based on this threshold, it can be concluded that the "access to technology and technical knowledge" factor has a significance value that falls below the threshold of 6.38. Therefore, this factor will be removed from further consideration, and the remaining factors with a significance value greater than the threshold will be selected for analysis.

Table 4-4. Sub-factors of the support dimension. Source: Author's own construction

Dimensions of the main factors	Pessimistic amount		Optimistic amount		Optimistic amount	Geometric mean	Significant amount	Rank
	lowest	highest	lowest	highest	J_m^i	u_m^i		
Access to the clean energy distribution network	1	10	4	10	5.17	7.98	8.47	3
Stability of macro policies and approaches in the field of clean energy	2	10	5	10	6.38	8.63	10.15	1
Adequate support from competent authorities	4	9	6	10	6.57	8.37	8.46	4
Absence of cumbersome regulations in the field of investment	4	8	7	9	5.2	7.6	9.09	2
Targeting energy subsidies	1	6	2	9	2.34	5.28	2.95	5

Threshold=7.82*

Based on the mean value of the significant value column, which is 7.82, it can be concluded that the sub-factor "Targeting subsidies in the energy sector" is less significant compared to the other sub-factors, as its score falls below the threshold of 7.82. Therefore, this sub-factor will be removed from further consideration, and the remaining sub-factors with a significance value greater than the threshold will be selected for analysis.

Table 5-4. Environmental and social sub-factors

Source: Author's own construction

Dimensions of the main factors	**Pessimistic amount**		**Optimistic amount**		**Optimistic amount**	**Geometric mean**	**Significant amount**	**Rank**
	lowest	**highest**	**lowest**	**highest**	J_m^i	u_m^i		
Attention to social responsibility in the field of environment	2	9	7	10	6.41	8.61	11.2	1
The value of investment thinking in the field of clean energy	3	9	6	9	3.76	7.59	8.9	4
Attention to environmental laws and regulations	2	9	6	10	5.48	8.38	9.34	3
social acceptance	1	7	2	9	2.44	5.44	3.56	5
Awareness of the benefits of clean and renewable energy	1	9	7	10	5.05	8.67	11.3	2

Threshold=8.81*

The mean of the significant value column was calculated to be 8.81, which serves as the threshold limit for determining the significance of the sub-factors. Based on this threshold, it can be concluded that the "social acceptance" sub-factor has a significance value that falls below the threshold of 8.81 when compared to the other sub-factors. Therefore, this sub-factor will be removed from further consideration, and the remaining sub-factors with a significance value greater than the threshold will be selected for analysis.

Table 6-4. Sub-factors of the legal and administrative dimension

Source: Author's own construction

Dimensions of the main factors	Pessimistic amount		Optimistic amount		Optimistic amount	Geometric mean	Significant amount	Rank
	lowest	highest	lowest	highest	J_m^i	u_m^i		
Stability in investment rules and regulations	2	9	7	10	4.26	8.49	9.39	3
Support system for the guaranteed purchase of clean energy	1	7	3	9	2.34	5.54	3.96	5
Existence of administrative system facilitating investment	4	9	7	9	6.93	8.47	13.71	1
Increasing the awareness of government managers about clean energy	4	8	7	9	5.33	7.6	9.24	4
Tax incentives for clean energy investors	2	9	8	10	4.99	8.68	11.97	2

Threshold=9.08*

Based on the mean of the significant value column, which was calculated to be 9.08, a threshold limit was established to determine the significance of the sub-factors. It can be inferred that the "support system for the guaranteed purchase of clean energy" sub-factor has a significance value lower than the threshold when compared to the other sub-factors. Therefore, this sub-factor will be eliminated, and the remaining sub-factors with a significance value greater than the threshold will be considered for further analysis.

4-2 ranking of factors identified by hierarchical analysis method

The methodology utilized in this research, which is based on the Analytic Hierarchy Process (AHP), consists of four fundamental steps. The subsequent section will detail each of these four steps.

First step: Compilation of AHP hierarchical tree based on the research problem;

Initially, a hierarchical tree was created based on the main and secondary factors identified through expert opinions in the initial phase. The hierarchical tree consists of 5 main factors and 20 influential sub-factors, as illustrated in diagram (1-4).

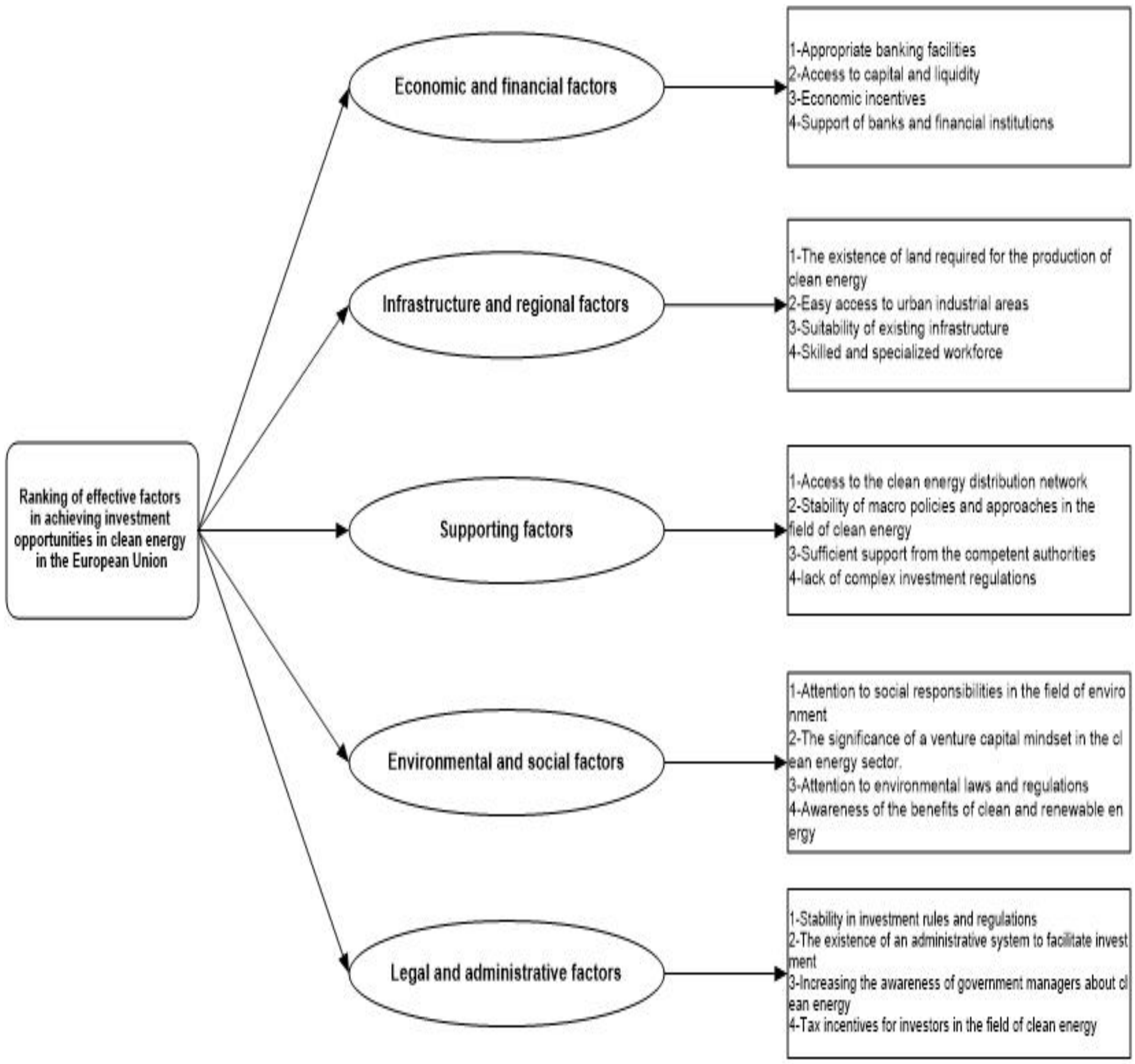

Figure 1-4. Hierarchical tree of main and secondary factors

Source: Author's own construction

Second step: Calculate the weight of the main factors (level one)

To determine the relative significance (weight) of each of the main factors, a survey was conducted using the AHP questionnaire format (pairwise comparison) to gather expert opinions. The questionnaire consists of a pairwise comparison matrix for the factors, which means that the number of comparisons or questions is equal to the number of factors squared. Considering that level one had 5 factors, the number of comparisons or questions is equal to:

$$\frac{n(n-1)}{2} = \frac{5(5-1)}{2} = 10$$

Once the questionnaires were completed, the inconsistency rate of each questionnaire was verified individually. Subsequently, the opinions of the 20 participants were analysed and aggregated using the Expert Choice Team software. The Expert Choice Team software is equipped with various tools to gather pairwise comparison matrices from different experts and combine them into a single matrix. This is achieved by taking the geometric mean of the individual elements in the matrices of each expert.

Table 7-4. Combined matrix (geometric) of level one group pairwise comparisons

Source: Author's own construction

The main criterion	A	B	C	D	E	Weights	Rank
A	1	1.059	1.718	1.245	1.947	0.268	1
B	0.944	1	0.725	0.758	0.498	0.153	5
C	0.582	1.379	1	1.135	1.001	0.189	4
D	0.803	1.319	0.881	1	1.214	0.197	2
E	0.514	2.008	0.999	0.824	1	0.192	3
IR=0.03<0.01							
A= Economic and financial factors B= Infrastructure and regional factors C=Supporting factors D=Environmental and social factors E=legal and administrative factors							

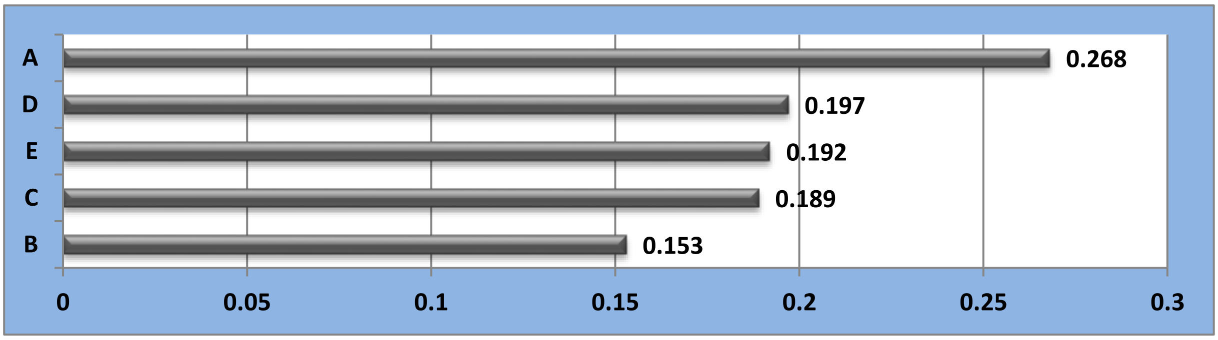

Figure 2-4. Value of the main factors.

Source: Author's own construction

The analysis of Table 7-4 indicates that the weights of the main factors were calculated, and it shows that the economic and financial factor is ranked first with a relative weight of 0.268. The environmental and social factor is in second place with a relative weight of 0.197, followed by the legal and administrative factor in third place with a relative weight of 0.192. The supporting factor is in fourth place with a relative weight of 0.189, and finally, the infrastructure and regional factor is in fifth place with a relative weight of 0.153.

Analysis of calculations in Table 7-4

For example, the geometric mean of a_{12} is calculated as follows.

$$a_{12} = (1 \times .... \times 5)^{\frac{1}{20}} = 1.059$$

The analysis hierarchy method (AHP) follows the inevitability principle, meaning that the elements below the diagonal matrix are the reciprocal of the elements above the diagonal. For example, the volume a_{21} is obtained as follows.

$$a_{21} = \frac{1}{1.059} = 0.944$$

The rest of the elements of the table are obtained in such a way that the results are as described in Table 1-4.

The method of calculating the weights of level one is explained as follows.

After obtaining the geometric mean of the opinions of the experts involved in the study, the decision-making matrix of the problem is normalized using the following formula.

$$r_{ij} = \frac{\overline{a_{ij}}}{\sum_{i=1}^{n} \overline{a_{ij}}}$$

To obtain the normalized matrices r_{11} and r_{21}, the following steps were taken. Firstly, the sum of all numbers in the first column of the integrated (geometric) matrix was calculated as follows:

$$\sum_{i=1}^{5} \overline{a_{i1}} = 1 + 0.944 + 0.582 + 0.803 + 0.514 = 3.843$$

Then we divide the number $\bar{a}_{11}$ of the integrated (geometric) matrix by the sum total of the first column

($\sum_{i=1}^{n} \overline{a_{ij}}$).

$$\overline{a_{11}} = \frac{1}{3.843} = 0.260$$

The rest of the normalized matrix elements are calculated according to the above formula, the results of which can be checked in Table 8-4.

Table 8-4- The normalized matrix of level one pairwise comparisons

Source: Author's own construction

Main factors	A	B	C	D	E	Line summation	Weights	Rank
A	0.260	0.157	0.323	0.251	0.344	1.334	0.268	1
B	0.246	0.148	0.136	0.153	0.088	0.770	0.153	5
C	0.151	0.204	0.188	0.229	0.177	0.949	0.189	4
D	0.209	0.195	0.166	0.202	0.214	0.985	0.197	2
E	0.134	0.297	0.188	0.166	0.177	0.961	0.192	3

Once the group decision-making matrix is normalized, the next step is to calculate the weights of the level one components. This can be done using the row average method, which is expressed by the following formula.

$$W_i = \frac{\sum_{i=1}^{n} w_{ij}}{n} \text{ , } j = 1,2,\dots, n \qquad , \sum_{i=1}^{n} W_i = 1$$

For example, to calculate the weight of **A**, we first add all the elements of the first row of the normalized matrix together, and then divide by the number of all the desired main factors, which is 5.

$$\frac{\sum_{i=1}^{n} w_{ij}}{n} = \frac{0.260 + 0.157 + 0.323 + 0.251 + 0.344}{5} = 0.267$$

In this way, the rest of the weights were calculated in the above way, the results of which are shown in Table 7-4.

- Calculation of the inconsistency rate of the group decision-making matrix

To ensure the reliability of the criteria ranking and weighting, it is necessary to calculate the inconsistency ratio (I.R) of the pairwise comparison matrix. The steps for computing the inconsistency ratio are as follows.

First step) calculation of weighted sum vector (WSV):

$$WSV = D \times W$$

First, we multiply the pairwise comparison matrix D (Table 6-4) by the vector of relative weights (W):

$$\textbf{WSV =} \begin{bmatrix} 1 & 1.059 & 1.718 & 1.245 & 1.947 \\ 0.944 & 1 & 0.725 & 0.758 & 0.498 \\ 0.582 & 1.379 & 1 & 1.135 & 1.001 \\ 0.803 & 1.319 & 0.881 & 1 & 1.214 \\ 0.514 & 2.008 & 0.999 & 0.824 & 1 \end{bmatrix} * \begin{bmatrix} 0.268 \\ 0.153 \\ 0.189 \\ 0.197 \\ 0.192 \end{bmatrix} = \begin{bmatrix} 1.374 \\ 0.788 \\ 0.972 \\ 1.014 \\ 0.988 \end{bmatrix}$$

Second step: calculation of compatibility vector (CV):

We divide the elements of the total weighted vector by the vector of relative weights. The resulting vector is called compatibility vector.

$$\textbf{CV =} \begin{bmatrix} 1.374 \\ 0.788 \\ 0.972 \\ 1.014 \\ 0.988 \end{bmatrix} \div \begin{bmatrix} 0.268 \\ 0.153 \\ 0.189 \\ 0.197 \\ 0.192 \end{bmatrix} = \begin{bmatrix} 5.126 \\ 5.150 \\ 5.142 \\ 5.145 \\ 5.146 \end{bmatrix}$$

Third step: calculation of the largest eigenvalue of the matrix of pairwise comparisons $\lambda_{\max}$:

$$\lambda_{\max} = \frac{5.126 + 5.150 + 5.142 + 5.145 + 5.146}{5} = 5.142$$

Step fourth: Calculating the inconsistent index (II): The inconsistent index is calculated as follows:

$$II = \frac{5.142 - 5}{5} = 0.028$$

Fifth step: calculation of incompatibility rate (IR): for this purpose, it is done in the following order:

$$IR = \frac{II}{IRI} = \frac{0.028}{1.12} = 0.03 \leq 0.1$$

Here, IRI (Random Incompatibility Index) is a value that is extracted from the relevant table. This value is equal to 1.12 for the matrix with dimension n=5.

Finally, the inconsistency rate of the desired matrix is equal to (IR=0.03) and since this value is less than 0.1, therefore, there is consistency in pairwise comparisons.

Third step: calculating the weight of level two elements (local weights):

The third phase involves computing the weight of the influential subcategories within each subgroup, and the tables below illustrate the outcomes.

Table 9-4. Pairwise comparison matrix of economic and financial sub-factors

Source: Author's own construction

Economic and financial	A1	A2	A3	A4	Weights	Rank
A1	1	1.643	2.086	2.236	0.380	1
A2	0.608	1	1.728	1.844	0.271	2
A3	0.479	0.578	1	2.885	0.224	3
A4	0.447	0.542	0.346	1	0.126	4
IR=0.05<0.01						

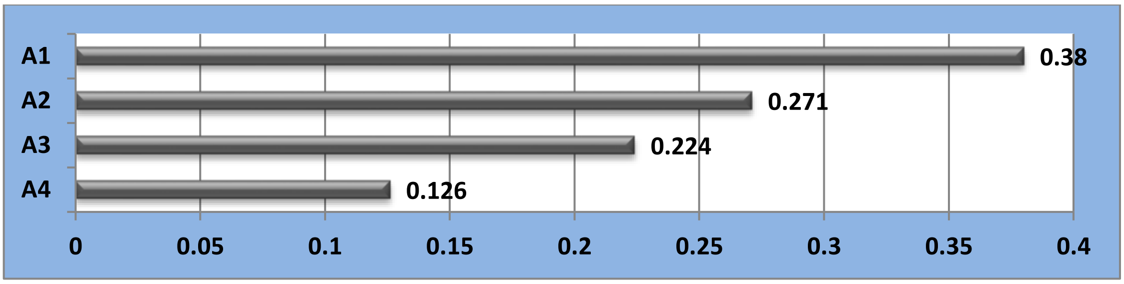

Figure 3-4.Weights of economic and financial sub-factors

Source: Author's own construction

According to the analysis in Table 4-9, which determined the weights of economic and financial sub-factors, the primary factor is banking facility, which has a relative weight of 0.380. The second-most important factor is access to capital and liquidity, with a relative weight of 0.271, followed by economic incentives, which have a relative weight of 0.224 and are ranked third. The support of banks and financial institutions is fourth, with a relative weight of 0.126. In conclusion, the inconsistency rate of the target matrix is 0.05. As this value is lower than 0.1, it indicates that there is consistency among the experts' evaluations in the pairwise comparisons of the target matrix.

Table 10-4. Pairwise comparison matrix of infrastructure and regional sub-factors

Source: Author's own construction

Infrastructure and regional	B1	B2	B3	B4	Weights	Rank
B1	1	1.212	2.825	1.551	0.363	1
B2	0.825	1	1.191	0.549	0.206	3
B3	0.353	0.839	1	0.651	0.156	4
B4	0.644	1.820	1.536	1	0.275	2
IR=0.03<0.01						

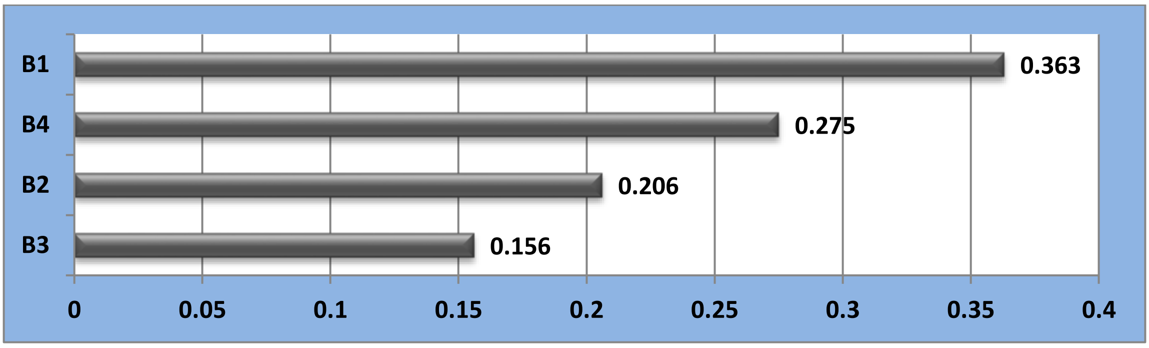

Figure 4-4. Weights of infrastructure and regional sub-factors

Source: Author's own construction

According to the analysis presented in Table 10-4, which computed the weights of infrastructure and regional sub-factors, the leading factor is the land necessary for generating clean energy, which has a relative weight of 0.363. In second place is skilled and expert labour, with a relative weight of 0.275, followed by easy access to industrial and urban areas in third place, with a relative weight of 0.206. The appropriateness of existing infrastructure is ranked fourth, with a relative weight of 0.156. In the end, the inconsistency rate of the target matrix is 0.03, which is below 0.1. Therefore, it implies that there is consistency in the experts' evaluations regarding the pairwise comparisons of the target matrix.

Table 11-4. Pairwise comparison matrix of support sub-factors

Source: Author's own construction

Supportive	C1	C2	C3	C4	Weights	Rank
C1	1	1.098	1.216	2.236	0.309	2
C2	0.910	1	2.371	2.000	0.344	1
C3	0.822	0.421	1	1.556	0.203	3
C4	0.447	0.500	0.642	1	0.144	4
IR=0.02<0.01						

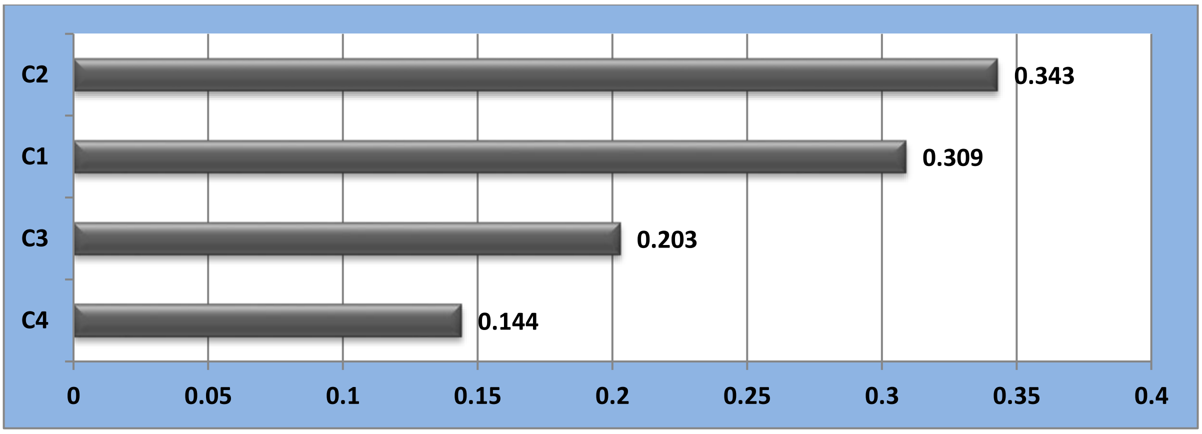

Figure 5-4. Weights of supporting sub-factors

Source: Author's own construction

The analysis presented in Table 11-4 computed the weights of supporting sub-factors, and the results indicate that the primary factor is the stability of macro policies and approaches in the area of clean energy, which has a relative weight of 0.343. The second-most significant factor is access to the energy distribution network for clean products, with a relative weight of 0.309. The third factor is having sufficient support from competent authorities, with a relative weight of 0.203, and the fourth factor, which is the absence of cumbersome regulations in the field of investment, has a relative weight of 0.144 and is also important. In conclusion, the inconsistency rate of the desired matrix is 0.02, which is below 0.1. Therefore, it indicates that there is consistency among the experts' evaluations regarding the pairwise comparisons of the desired matrix.

Table 12-4. Pairwise comparison matrix of environmental and social sub-factors

Source: Author's own construction

Environmental and social	D1	D2	D3	D4	Weights	Rank
D1	1	0.822	1.933	1.132	0.259	2
D2	1.216	1	5.532	1.397	0.402	1
D3	0.517	0.180	1	0.572	0.109	4
D4	0.883	0.715	1.748	1	0.229	3
IR=0.3<0.1						

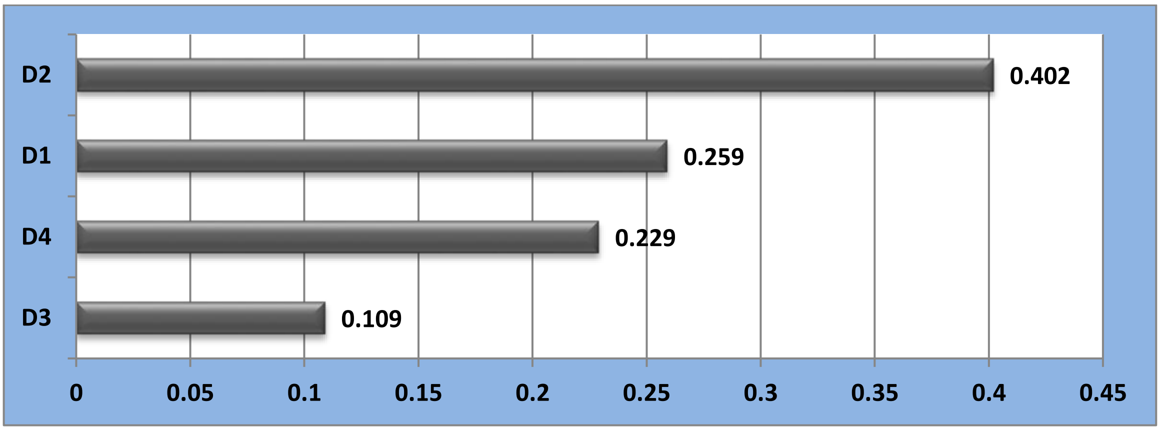

Figure 6-4. Weights of environmental and social sub-factors

Source: Author's own construction

The weights of environmental and social sub-factors were computed in Table 12-4, and the results indicate that the most significant factor is investment thinking in the clean energy field, with a relative weight of 0.402. The second most important factor is attention to social responsibility in the environmental field, with a relative weight of 0.259. The third factor is awareness of the benefits of clean and renewable energies, with a relative weight of 0.229. The fourth factor, with a relative weight of 0.109, is attention to environmental laws and regulations. Finally, the inconsistency rate of the desired matrix is equal to (IR=0.03) and since this value is less than 0.1, therefore, there is consistency in the judgment of the experts in the pairwise comparisons of the desired matrix.

Table 13-4. Pairwise comparison matrix of legal and administrative sub-factors

Source: Author's own construction

Legal and administrative	E1	E2	E3	E4	Weights	Rank
E1	1	0.501	0.452	0.832	0.161	4
E2	1.993	1	0.871	0.696	0.275	2
E3	2.208	1.148	1	1.000	0.306	1
E4	1.201	1.031	1.000	1	0.258	3
IR=0.02<0.01						

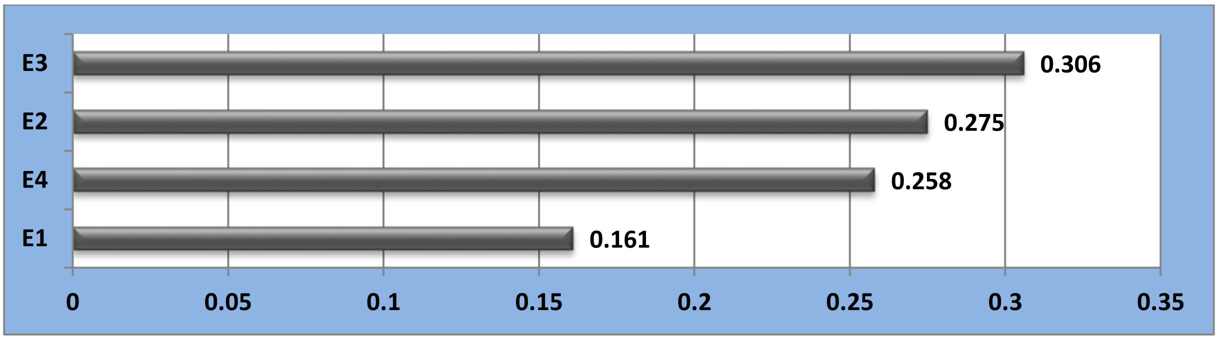

Figure 7-4. Weights of legal and administrative sub-factors

Source: Author's own construction

The weights of legal and administrative sub-factors were computed in Table 13-4, and the results show that the most important factor is increasing the awareness of government managers about clean energy, with a relative weight of 0.306. The second most significant factor is the existence of a facilitating administrative system in the matter of capital investment, with a relative weight of 0.275. The third factor is tax incentives for investors in the field of clean energy, with a relative weight of 0.258. The fourth factor, with a relative weight of 0.161, is stability in the rules and regulations related to investment. Finally, the inconsistency rate of the target matrix is equal to (IR=0.02) and since this value is less than 0.1, therefore, there is consistency in the experts' judgments in the pairwise comparisons of the target matrix.

Fourth step: final weight of elements

The last step involves calculating the final weight of each element in a group, which is obtained by multiplying the local weight of each element by the weight of the head of its group (main factor) and the final ranking of each factor that affects the attainment of investment opportunities in clean energy in the European Union. Table 14-4 displays the results of this step.

Table 14-4. The final ranking of influential factors

Source: Author's own construction

Main factors	Weight of main factors	Secondary factors	Local weighting of sub factors	Final weight	Rank (priority)
Economical and financial A	0.268	**A1**	0.380	0.102	1
		A2	0.271	0.073	3
		A3	0.224	0.060	5
		A4	0.126	0.034	15
Infrastructure and regional B	0.153	**B1**	0.363	0.055	8
		B2	0.206	0.032	16
		B3	0.156	0.024	19
		B4	0.275	0.042	13
Supportive C	0.189	**C1**	0.309	0.058	7
		C2	0.343	0.065	4
		C3	0.203	0.038	14
		C4	0.144	0.027	18
Environmental and social D	0.197	**D1**	0.259	0.051	10
		D2	0.402	0.079	2
		D3	0.109	0.021	20
		D4	0.229	0.045	12
Legal and administrative E	0.192	**E1**	0.161	0.031	17
		E2	0.275	0.053	9
		E3	0.306	0.059	6
		E4	0.258	0.050	11

Analysis results: The results obtained from analysing Table 14-4 show that the most important factor affecting investment opportunities in clean energy in the European Union is bank facilities, with a relative weight of 0.102. In the second place is the factor of investing in clean energy with a relative weight of 0.079, followed by the factor of access to capital and liquidity with a relative weight of 0.073 in the third place. The fourth place is occupied by the factor of stability of policies and macro approaches in the field of clean energy, with a relative weight of 0.065, while the fifth place is held by the factor of economic incentives, with a relative weight of 0.060. Other factors include an increase in government managers' knowledge about clean energy, access to the clean energy distribution network, availability of land required for clean energy production, a facilitating administrative system in the matter of investment, attention to social responsibility in the environmental field, tax incentives for clean energy investors, awareness of the benefits of clean and renewable energies, a skilled and expert labour force, sufficient support from competent authorities, supporting banks and financial institutions, easy access to industrial and urban areas, stability in laws and regulations related to investment, lack of cumbersome regulations in the field of investment, appropriateness of existing infrastructures, and paying attention to environmental laws and regulations. These factors are ranked in order of importance from first to twentieth, based on their relative weights.

5 Conclusion and Recommendations

5-1 Introduction

The outcomes and discoveries of every study are crucial and serve as the backbone of the research. They provide a foundation for improvement and advancement by validating the hypotheses and setting a benchmark for future research. The suggestions from the research also call us to change and renew. Undoubtedly, the pivotal component of a thesis is the section that pertains to the conclusion and discourse of the research outcomes. This is because the goal of conducting research and all the measures that need to be taken in a thesis is to showcase the obtained results with regards to the research hypotheses. The preceding chapter focused on statistical tables, data analysis, and hypothesis testing, whereas the current chapter presents a synopsis of the research and the final analysis of hypotheses to formulate a conclusion, while taking into account the research's limitations. Towards the end of this chapter, practical suggestions are made along with recommendations for future researchers in the field of the research's components.

5-2 results from answering the research questions

The primary objective of this study is to utilize the hierarchical analysis method to identify and rank the factors that influence the attainment of investment opportunities in clean energy in the European Union by answering one major question and five sub-questions. The subsequent section will explore each of the inquiries addressed in this research.

5-2-1 result from answering the main question

The main question: What is the priority of the main factors affecting the achievement of investment opportunities in clean energy in the European Union?

The objective of this research is to use the hierarchical analysis method to identify and rank the factors that influence the achievement of clean energy investment opportunities in the European Union, with a main question and five sub-questions to be answered. In the first sub-question, the aim is to determine the primary factors that impact investment opportunities in clean energy in the European Union. To achieve this, the research team conducted a literature review of articles, books, and theses in both Latin and Persian, resulting in the identification of five main criteria: environmental and social factors, legal and administrative factors, supportive factors, infrastructural and regional factors, and economic and financial factors. Experts were then consulted to refine the sub-criteria within each main criterion, and an initial questionnaire was distributed. In the second stage, an AHP questionnaire was used to calculate the relative importance (weight) of each main and secondary factor, obtained through experts' opinions.

Table 1-5. Identification of the main factors of investment opportunities

Source: Author's own construction

Symbol	Main factors	Weight (relative importance factor)	Rank
A	Economic and financial	0.268	1
B	Infrastructure and regional	0.153	5
C	Supportive	0.189	4
D	Environmental and social	0.197	2
E	Legal and administrative	0.192	3

Based on the findings, it can be concluded that the countries within the European Union need to take into account the priorities identified in this study to offer solutions that will facilitate the attainment of clean energy investment opportunities. Among the identified main factors, "Economic and financial," "Environmental and social," and "Legal and administrative" are the most important. Therefore, to achieve investment opportunities in clean energy, it is essential to prioritize these three factors.

5-2-2 result from answering sub-questions

- The first sub-question: What is the priority of the economic and financial sub-factors, affecting the achievement of investment opportunities in clean energy in the European Union?

The purpose of this question is to rank (weight calculation) sub-factors related to the economic and financial factor, the results of which are as follows.

Table 2-5. Ranking of each of the economic and financial sub-factors

Source: Author's own construction

Symbol	Main factors	Weight (relative importance factor)	Rank
A1	Appropriate banking facilities	0.380	1
A2	Access to capital and liquidity	0.271	2
A3	Economic incentives	0.224	3
A4	Banks and financial institutions support	0.12	4

Based on the results, it can be concluded that the senior officials responsible for clean energy development should prioritize providing solutions for the identified factors in order to achieve investment opportunities in clean energy. Among these factors, "adequate banking facilities" and "access to capital and liquidity" were identified as more important. Therefore, these two factors should be given more attention to facilitate investment opportunities in clean energy in the European Union.

- The second sub-question: How is the priority of infrastructure and regional sub-factors, affecting the achievement of clean energy investment opportunities in the European Union?

The purpose of this question is to rank sub-factors (infrastructural and regional factors) and the results are as follows.

Table 3-5. Rank of each of the sub-factors of the infrastructure and regional factors

Source: Author's own construction

Symbol	Main factors	Weight (relative importance factor)	Rank
B1	The existence of land required for the production of clean energy	0.363	1
B2	Easy access to industrial and urban areas	0.206	3
B3	Suitability of existing infrastructure	0.156	4
B4	Skilled and specialized workforce	0.275	2

Based on the results, it can be concluded that addressing the factors of "Availability of land for clean energy production" and "Availability of skilled and specialized workforce" should be prioritized by senior officials of relevant organizations in the clean energy sector. These two factors have been identified as more important compared to other factors in achieving investment opportunities in clean energy in the European Union. Therefore, it is essential to pay attention to these factors to promote clean energy investments in the region.

- The third sub-question: How is the priority of supporting sub-factors affecting the achievement of investment opportunities in clean energy in the European Union?

The purpose of this question is to rank sub-factors (supportive factors) and the results are as follows.

Table 4-5. The rank of each of the sub-factors of the support factor

Source: Author's own construction

Symbol	Main factors	Weight (relative importance factor)	Rank
C1	Access to the clean energy distribution network	0.309	2
C2	Stability of macro policies and approaches in the field of clean energy	0.343	1
C3	Adequate support from competent authorities	0.203	3
C4	Absence of cumbersome regulations in the field of investment	0.144	4

Based on the results obtained, it can be concluded that senior officials of relevant organizations in the clean energy industry should focus on addressing the identified factors in order of priority. Among these factors, "Stability of macro policies and approaches in the field of clean energy" and "Access to the distribution network of clean energy" were found to be more crucial compared to other factors. Therefore, it is essential to prioritize addressing these two factors to facilitate investment opportunities in clean energy in the European Union.

- The fourth sub-question: How is the priority of environmental and social sub-factors, affecting the achievement of investment opportunities in clean energy in the European Union?

The purpose of this question is to rank secondary factors (environmental and social factors), and the results are as follows.

Table 5-5. The rank of each sub-factor of the environmental and social factor

Source: Author's own construction

Symbol	Main factors	Weight (relative importance factor)	Rank
D1	Attention to social responsibility in the field of environment	0.259	2
D2	The value of investment thinking in the field of clean energy	0.402	1
D3	Attention to environmental laws and regulations	0.109	4
D4	Awareness of the benefits of clean and renewable energy	0.229	3

Based on the results, it can be stated that the senior officials responsible for clean energy development should prioritize addressing each of the identified factors. Among these factors, "Perception of the value of investing in clean energy" and "Consideration of environmental social responsibility" were identified as particularly important. Thus, it is essential to address these two factors in order to promote investment opportunities in clean energy within the European Union.

- The fifth sub-question: What is the priority of the legal and administrative sub-factors affecting investment opportunities in clean energy in the European Union?

The purpose of this question is to rank secondary factors (legal and administrative factors), and the results are as follows.

Table 6-5. The rank of each of the legal and administrative sub-factors

Source: Author's own construction

Symbol	Main factors	Weight (relative importance factor)	Rank
E1	Stability in investment rules and regulations	0.161	4
E2	The existence of an administrative system facilitating investment	0.275	2
E3	Increasing the awareness of government managers about clean energy	0.306	1
E4	Tax incentives for investors in the field of clean energy	0.258	3

Based on the results, it can be concluded that the senior officials of competent organizations in the field of clean energy development should focus on finding solutions for the identified factors according to the given priorities. Among these factors, "Increasing the awareness of government managers regarding clean energy" and "the existence of an administrative system facilitating investment" have higher importance compared to the other identified factors. Thus, it is essential to pay close attention to these two factors as they are critical in achieving investment opportunities in clean energy in the European Union.

5-3 Discussion and suggestions according to the research result

Humanity has been acquainted with various forms of energy since the discovery of fire, and energy has now become a fundamental element of life. Energy is closely linked to the economy, social issues, and environmental concerns, which has led to the recognition of energy as a strategic commodity and energy infrastructure as a crucial infrastructure. As a result of this, organizations such as the International Energy Agency and the United Nations Energy Committee have been established (Zhou, et al., 2010). In this research, an effort was made to get acquainted with the types of clean energy and to find out the factors affecting investment opportunities in clean energy in the European Union. In a brief overview of the concept of clean energy, it can be said that clean or renewable energy refers to energy that is produced from sources that can be naturally regenerated over time, unlike fossil fuels. Advancements in technology have led to the increased application of renewable energy in various systems to meet their energy needs. Examples of renewable energy sources include solar, wind, biomass, geothermal, hydroelectric, waves, solid biomass, bio gas, and bio fuels (Kaltschmitt, et al., 2007).The significance of utilizing clean energy and its impact on the economic progress and advancement of nations remains a crucial topic in energy and economic discussions, particularly in developed countries. Hence, this study focused on examining the factors that influence the attainment of investment opportunities in clean energy, with the European Union being a vital region in the world that addresses the matter of clean energy.

Certainly, the identification and enhancement of factors that impact investment opportunities in clean energy within the European Union can help achieve economic, environmental, and social objectives linked to the use of clean energy for countries located in the EU. As a result, based on the ranking results of each effective factor in investment opportunities in clean energy within the EU, proposals have been offered.

* Based on the results obtained from the research regarding the sub-factors associated with economic and financial factors, the following recommendations are put forward.

- One suggestion to incentivize investors in the clean energy sector is for EU member states to offer banking facilities commensurate with the investment amount.

- It is suggested to provide banking facilities to make liquidity available to investors so that they can move their capital without worry.

- It is suggested that EU member states consider economic incentives for investors in the field of clean energy.

* Based on the results obtained from the research related to the sub-factors associated with infrastructure and regional factors, the following recommendations are proposed.

- Considering the existing land restrictions in some EU member states, it is suggested to provide the land needed by the investors in the field of clean energy.

- In order to facilitate the projects of investors in the field of clean energy, regulations should be provided so that they do not face any problem in providing skilled and specialized manpower from other countries.

- To expedite the implementation of clean energy projects by investors, it is important to ensure their easy access to industrial and urban areas. Therefore, it is suggested to allocate suitable areas for investors that possess such characteristics.

* Based on the results of the research regarding the sub-factors related to the support factor, the following recommendations are put forward.

- Given that the distribution of energy is the second stage after investment in clean energy production, it is suggested that relevant organizations should plan and establish appropriate distribution networks in parallel with the development of clean energy investment projects.

- In order to encourage investors in the field of clean energy, the member states in the European Union should pay attention to a long-term horizon when formulating policies and macro policies in this field of energy.

-To make the investment process in clean energy easier, it is suggested that the relevant organizations with expertise in this area effectively fulfil their role as facilitators.

* Based on the research results for the fourth question, which relates to the sub-factors of environmental and social factors, the following recommendations are proposed.

- It is suggested that in order to take advantage of investment opportunities in the field of clean energy in EU member countries, the value of thinking about investment in the field of clean energy should be developed among officials, managers and people related to this matter.

- In order to prevent environmental damage, it is recommended that before attracting investors in the field of clean energy, their plans should be considered from the perspective of social and environmental responsibilities.

- To promote the use of clean energy among the public, it is suggested that EU member states educate their citizens on the advantages of using renewable energy sources.

* Based on the results of the research for the fifth question, which pertains to the sub-factors associated with the legal and administrative aspects, the following recommendations are provided.

- In order to facilitate the process of obtaining necessary permits for investment in the field of clean energy, the existence of an administrative system that facilitates investment is very important.

- It is suggested that EU member states offer tax incentives to investors in the clean energy sector in order to encourage them.

-To expedite and streamline investments in clean energy across the member countries of the European Union, it is essential to enhance the understanding of government officials with respect to clean energy.

5-4 Providing recommendations for future research to researchers

Future researchers are advised to include the following in their research.

1- The group of experts in the energy sector in Hungary was selected as the statistical population for this study. It is recommended that future studies be conducted among economic practitioners in other European Union countries and compare the outcomes with the findings of this research.
2- Researchers who are interested in the topic of clean energy investment opportunities in the European Union are recommended to explore alternative methods such as TOPSIS, linear programming, and fuzzy logic.

5-5 Research limitations

To conduct research is inevitable to encounter limitations. A competent researcher is someone who can acknowledge and identify these limitations and strive to address them if possible. Some of the limitations in this research are:

- Experts on the decision-making team may have limited understanding of how to complete paired comparison questionnaires.
- Limited resources were available for research on the subject, resulting in a scarcity of relevant materials from libraries and research centers.

6 Summary

The primary objective of this study is to recognize and rank the factors that have an impact on the success of investment opportunities in clean energy within the European Union, utilizing the Analytical Hierarchy (AHP) technique and expert viewpoints. Initially, a list of main factors that impact clean energy investment opportunities in the European Union was established through a literature review and the insights of professors, specialists, and experts. The next phase involved the identification of secondary factors, whereby experts with experience in investment and the clean energy industry were consulted through face-to-face interviews. Their opinions were analysed and condensed into a questionnaire to identify the sub-indicators.

Upon analysing the data with the fuzzy Delphi method and using SPSS software, 20 out of 25 sub-factors that were identified as having an impact on the achievement of investment opportunities in clean energy in the European Union were selected as the most favourable by the decision-making team. After aggregating the opinions, a total of 20 effective sub-factors were identified and categorized into 5 main factors affecting the achievement of investment opportunities in clean energy in the European Union. The analysis indicated that the economic and financial factor was the most important with a relative weight of 0.268, followed by the environmental and social factor with a relative weight of 0.197 in the second position. The legal and administrative factor was ranked third with a relative weight of 0.192, while the support factor was in fourth place with a relative weight of 0.189, and the infrastructure and regional factor was last with a relative weight of 0.153.

This study followed a structured framework consisting of five chapters. The first chapter included a general introduction of the research topic, problem statement, significance and purpose of the study, research goals, questions, and conceptual definitions. In the second chapter, the theoretical literature of the research was reviewed, which included definitions, concepts, models, and historical studies conducted inside and outside the country. The third chapter focused on the research methodology, which included the research method, research variables, data collection tools, and statistical methods used for data analysis. The fourth chapter analysed the statistical data in detail. The fifth and final chapter summarized the research findings, which were obtained through the use of hierarchical method (AHP) and presented suggestions based on the results. Finally, recommendations for future research were provided.

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Annex 2: Questionnaire Number 1(AHP)

Questionnaire number (1) Fuzzy Delphi technique to identify the main criteria

Dear expert

The questionnaire enclosed is a component of a scientific study aimed at assessing the factors that impact investment opportunities in clean energy in the European Union. The advance questionnaire has examined the importance of the main indicators. Your input would be highly valuable in verifying the research results. Therefore, we kindly request that you assist us in completing the questionnaire.

In advance, I am grateful for your attention

If you are interested in knowing the results of this research, please enter your email in this section

Please express your opinion about the degree of importance of the following research criteria based on a 10-point scale of pessimistic and optimistic scoring from 1 to 10

No	Main criteria	Pessimistic value										Optimistic value									
		1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
1	Economic and financial																				
2	Infrastructure and regional																				
3	Supportive																				
4	Environmental and social																				
5	Legal and administrative																				
6	Political and government																				
7	Scientific and Educational																				

Dear respondent, if in your opinion there are other indicators that can play a role in identifying the factors and they are not mentioned in the above table, please mention them in this section.

Annex 3: Questionnaire Number 2(AHP)

Questionnaire number (2) Fuzzy Delphi technique to identify the sub-criteria

Dear expert

The questionnaire enclosed is a component of a scientific study aimed at assessing the factors that impact investment opportunities in clean energy in the European Union. The advance questionnaire has examined the importance of the sub indicators. Your input would be highly valuable in verifying the research results. Therefore, we kindly request that you assist us in completing the questionnaire.

In advance, I am grateful for your attention

If you are interested in knowing the results of this research, please enter your email in this section

Please express your opinion about the degree of importance of the following research criteria based on a 10-point scale of pessimistic and optimistic scoring from 1 to 10

<table>
<tr><th rowspan="2">Main criteria</th><th rowspan="2">Sub-criteria</th><th colspan="10">Pessimistic value</th><th colspan="10">Optimistic value</th></tr>
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<tr><td rowspan="5">Economic and financial</td><td>Appropriate banking facilities</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Access to capital and liquidity</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Low rates of clean energy and energy subsidies</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Economic incentives</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Support of banks and financial institutions</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="5">Infrastructure and regional</td><td>The existence of land required for the production of clean energy</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Easy access to industrial and urban areas</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Appropriateness of the existing infrastructure</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Access to technology and technical knowledge</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Skilled and specialized workforce</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Supportive	Access to the clean energy distribution network																				
	Stability of macro policies and approaches in the field of clean energy																				
	Adequate support from competent authorities																				
	Absence of cumbersome regulations in the field of investment																				
	Targeting energy subsidies																				
Environmental and social	Attention to social responsibility in the field of environment																				
	The value of investment thinking in the field of clean energy																				
	Attention to environmental laws and regulations																				
	social acceptance																				
	Awareness of the benefits of clean and renewable energy																				
Legal and administrative	Stability in investment rules and regulations																				
	Support system for the guaranteed purchase of clean energy																				
	Existence of administrative system facilitating investment																				
	Increasing the awareness of government managers about clean energy																				
	Tax incentives for clean energy investors																				

Dear respondent, if in your opinion there are other indicators that can play a role in identifying the factors and they are not mentioned in the above table, please mention them in this section.

Annex 4: Hierarchical analysis questionnaire (AHP)

Questionnaire

Dear respondent

Questionnaire No1, 2, 3, 4, 5, 6. The questionnaire enclosed is a component of a scientific study aimed at assessing the factors that impact investment opportunities in clean energy in the European Union. The hierarchy analysis (AHP) method has been used. Your input would be highly valuable in verifying the research results. Therefore, we kindly request that you assist us in completing the questionnaire.

Best regard

General questions

Gender

- Men
- Women

Age

- Less than 30
- 31-40
- 41 years and up

Education

- Bachelor degree -
- Master degree
- PhD degree

Work experience

- Less than 10 years
- 11-20
- Upper than 21 years

Field of study: ---

Field of activities: --

If you are interested in knowing the results of this research, please enter your email in this section

Questionnaire (**1**) Determining the importance of each **main factor**

<table>
<tr><td colspan="2">Compare two factors A and B with each other in pairs and indicate which one is more important by drawing a line under it.
Note: if both factors are the same in terms of importance. Underline both factors and mark the option of equal importance to no preference (1).</td><td colspan="9">The level of importance when comparing the <u>main factors</u> in pairs.</td></tr>
<tr><td>No</td><td>Main factors of pairwise comparison</td><td>9
Infinitely important</td><td>8</td><td>7</td><td>6</td><td>5
important</td><td>4</td><td>3</td><td>2</td><td>1
Equal importance or disinterested</td></tr>
<tr><td>1</td><td>A) Economic and financial
B) Infrastructure& regional</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>A) Economic and financial
B) Supportive</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>A)Economic and financial
B) Environmental and social</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>A) Economic and financial
B)Political and government</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>A)Infrastructure & regional
B) Supportive</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>A)Infrastructure & regional
B) Environmental and social</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>7</td><td>A)Infrastructure & regional
B)Legal and administrative</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>8</td><td>A)Supportive
B) Environmental and social</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>9</td><td>A)Supportive
B)Legal and administrative</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>10</td><td>A)Environmental & financial
B)Legal and administrative</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Questionnaire (**2**) Determining the importance of each **economic and financial** sub-factor

Compare two factors **A** and **B** with each other in pairs and indicate which one is more important by drawing a line under it. **Note**: if both factors are the same in terms of importance. Underline both factors and mark the option of equal importance to no preference (1).		The level of importance when comparing the **sub- factors** in pairs.								
No	**Economic and financial sub-factors for pairwise comparison**	9 Infinitely important	8	7	6	5 important	4	3	2	1 Equal importance or disinterested
1	**A)Appropriate banking facilities B) Access to capital and liquidity**									
2	**A)Appropriate banking facilities B)Economic incentives**									
3	**A)Appropriate banking facilities B)Support of banks and financial institutions**									
4	**A)Access to capital and liquidity B)Economic incentives**									
5	**A)Access to capital and liquidity B)Support of banks and financial institutions**									
6	**A)Low rates of clean energy and energy subsidies B)Support of banks and financial institutions**									

Questionnaire (**3**) Determining the importance of each **Infrastructure and regional** sub-factor

Compare two factors A and B with each other in pairs and indicate which one is more important by drawing a line under it. **Note**: if both factors are the same in terms of importance. Underline both factors and mark the option of equal importance to no preference (1).		The level of importance when comparing the **sub- factors** in pairs.								
NO	**Infrastructure and regional sub-factors for pairwise comparison**	9 Infinitely important	8	7	6	5 important	4	3	2	1 Equal importance or disinterested
1	**A)existence of land required for the production of clean energy B)Easy access to industrial and urban areas**									
2	**A)existence of land required for the production of clean energy B)Appropriateness of the existing infrastructure**									
3	**A)existence of land required for the production of clean energy B)Skilled and specialized workforce**									
4	**A)Easy access to industrial and urban areas B)Appropriateness of the existing infrastructure**									
5	**A)Easy access to industrial and urban areas B)Skilled and specialized workforce**									
6	**A)Appropriateness of the existing infrastructure B)Skilled and specialized workforce**									

Questionnaire (**4**) Determining the importance of each **Supportive** sub-factor

Compare two factors A and B with each other in pairs and indicate which one is more important by drawing a line under it. **Note**: if both factors are the same in terms of importance. Underline both factors and mark the option of equal importance to no preference (1).		The level of importance when comparing the **sub- factors** in pairs.								
NO	**Supportive sub-factors for pairwise comparison**	9 Infinitely important	8	7	6	5 important	4	3	2	1 Equal importance or disinterested
1	**A)Access to the clean energy distribution network B)Stability of macro policies and approaches in the field of clean energy**									
2	**A)Access to the clean energy distribution network B)Adequate support from competent authorities**									
3	**A)Access to the clean energy distribution network B)Absence of cumbersome regulations in the field of investment**									
4	**A)Stability of macro policies and approaches in the field of clean energy B)Adequate support from competent authorities**									
5	**A)Stability of macro policies and approaches in the field of clean energy B)Absence of cumbersome regulations in the field of investment**									
6	**A)Adequate support from competent authorities B)Absence of cumbersome regulations in the field of investment**									

Questionnaire (**5**) Determining the importance of each **Environmental and social** sub-factor

Compare two factors A and B with each other in pairs and indicate which one is more important by drawing a line under it. **Note**: if both factors are the same in terms of importance. Underline both factors and mark the option of equal importance to no preference (1).		The level of importance when comparing the **sub- factors** in pairs.								
NO	**Environmental and social sub-factors for pairwise comparison**	9 Infinitely important	8	7	6	5 important	4	3	2	1 Equal importance or disinterested
1	**A)Attention to social responsibility in the field of environment B)The value of investment thinking in the field of clean energy**									
2	**A)Attention to social responsibility in the field of environment B)Attention to environmental laws and regulations**									
3	**A)Attention to social responsibility in the field of environment B)Awareness of the benefits of clean and renewable energy**									
4	**A)The value of investment thinking in the field of clean energy B)Attention to environmental laws and regulations**									
5	**A)The value of investment thinking in the field of clean energy**									
6	**A)Attention to environmental laws and regulations B)Awareness of the benefits of clean and renewable energy**									

Questionnaire (**6**) Determining the importance of each **legal and administrative** sub-factor

Compare two factors A and B with each other in pairs and indicate which one is more important by drawing a line under it. **Note**: if both factors are the same in terms of importance. Underline both factors and mark the option of equal importance to no preference (1).		The level of importance when comparing the **sub- factors** in pairs								
NO	**Legal and administrative sub-factors for pairwise comparison**	9 Infinitely important	8	7	6	5 important	4	3	2	1 Equal importance or disinterested
1	**A)Stability in investment rules and regulations B)Existence of administrative system facilitating investment**									
2	**A)Stability in investment rules and regulations B)Increasing the awareness of government managers about clean energy**									
3	**A)Stability in investment rules and regulations B)Tax incentives for clean energy investors**									
4	**A)Existence of administrative system facilitating investment B)Increasing the awareness of government managers about clean energy**									
5	**A)Existence of administrative system facilitating investment B)Tax incentives for clean energy investors**									
6	**A)Increasing the awareness of government managers about clean energy B)Tax incentives for clean energy investors**									

Acknowledgment

My master career has taught different lesson which made me a better person in different aspects. As I move towards its completion, I would like to say big thank to my supervisor, Prof. Tibor László Csegődi, for providing guidance and feedback throughout this journey. I have to thank my parents for their love and support throughout my life. I would like to dedicate this research to them without whom it was almost impossible for me.

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