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Energy Transformation and the UAE Green Economy: Trade Exchange and Relations with Three Seas Initiative Countries

Adam Krzymowski 

Department of International Affairs and Social Sciences, Zayed University,
Abu Dhabi P.O. Box 144534, United Arab Emirates; ak7@vp.pl

Abstract: In 2015, on the initiative of Poland and Croatia, the Three Seas Initiative (3SI) was adopted, combining economic and political cooperation between 12 countries of Central and Eastern Europe, located between the three seas of the Adriatic, the Baltic, and the Black Sea. Since then, there has been a dynamic relationship between these countries and the United Arab Emirates. Consequently, most 3SI states have signed economic cooperation agreements, establishing the Joint Economic Committees (JEC). Therefore, this manuscript aims to answer the research question to what extent the visits at the highest level support the trade exchange between the United Arab Emirates (UAE) and the 3SI countries. Another question is, what are the cooperation prospects related to the energy transformation and initiatives on the green economy for sustainable development? To find the answer, the author implemented quantitative methods together with case studies. The results show that regular top-level visits support trade. At the same time, the study demonstrates a strategic potential for energy transformation.

Keywords: energy transformation; green economy; trade; three seas initiative; central eastern Europe; UAE



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1. Introduction

In 1989, the Polish Solidarity Movement contributed to the collapse of communism in Europe, the Berlin Wall fell, the Cold War was over, and Poland established diplomatic relations with the United Arab Emirates. Other Central and Eastern Europe countries, as free states, took similar decisions. The Three Seas Initiative (3SI), announced in 2015 and formally initiated in 2016, is a new platform for the cooperation of 12 countries located between the Adriatic, the Baltic, and the Black Sea. All these states are EU members. Moreover, in June 2022, Ukraine was granted the status of a participating country in 3SI. By developing transport, energy, and digital infrastructure from north to south, the Three Seas Initiative is 'the vision of a whole, free, and peaceful Europe' realization. The 3SI has a global dimension due to the geographical nearness of Russia, Turkey, the Mediterranean basin, the Middle East, and the activity of the USA and China. The dynamic development and stabilization in the Three Seas Initiative area affects Eurasia.

The research problem being investigated is the UAE's green economy with all 3SI countries. A green economy combines energy transformation, environmental protection, and carbon footprint reduction. The United Arab Emirates implements several initiatives and policies serving the green economy. Despite having enormous amounts of oil, Abu Dhabi is preparing for a post-oil economy. On the other hand, Dubai, which no longer has such natural resources, is determined to perform a much more profound economic transformation. UAE also demonstrates a commitment to reducing the consequences of climate change and strengthening the country's brand [1] (p. 21–22).

The presented paper aims to answer the research question of whether the high-level visits support the trade exchange between the United Arab Emirates and the 3SI countries. Another question is, what are the cooperation prospects related to the energy transformation

and initiatives on the green economy for sustainable development? The adopted hypothesis suggests a positive response to the first question. In another one, the author underlines that for the Three Seas Initiative and the UAE, there is great potential for cooperation in these fields, especially in renewable energy and organic food production. In addition, these countries can develop cooperation in IT, which will contribute to the efficient use of energy and infrastructure. A quantitative study with correlation analysis has been applied to understand the causes. To study processes, including political ones, machine learning based on algorithms and statistical models as the sub-field of artificial intelligence is becoming very useful [2]. Moreover, the theory of adaptation helps to describe characteristics. The energy transformation and implementation of green economy initiatives is an adaptation to the challenges and changes [3].

2. Materials and Methods

2.1. Literature Review

The author of this research published several papers on the UAE, including its relationship with the Three Seas Initiative countries. Within the main studies identified in the international literature, other authors analyze the foreign and economic policy of selected 3SI countries concerning the UAE or the Middle East, among others, Lu, Ren, Yao, Qiao, Strielkowski, and Streimikis. Regarding research on the UAE green economy and renewable energy, Naqbi, Tsai, and Mezher show achievements. Ali combines a green economy with sustainable development. By contrast, Tehreem, Mentel, Doğan, Hashim, and Shahzad demonstrate economic diversification and exports, including energy trading. Samour, Baskaya, and Tursoy show the FDI's role in renewable energy consumption. On the other hand, Salimi, Hosseinpour, and Borhani analyzed solar energy strategies for an energy transition. For this process, Griffiths focuses on energy diplomacy. Jaradat and Al-Tamimi show the influence of renewable energy on various elements of the economy. AlKhars, Miah, Qudrat-Ullah, and Kayal pay attention to energy consumption and economic growth. De Jong, Hoppe, and Noori underline the different situations in Abu Dhabi and Dubai in implementing a green economy. On the other hand, Alharbi and Csala carry out a comparative analysis of the UAE with other Gulf Cooperation Council countries in the aspect of energy transformation.

One of the vital regulations aimed at the transition to green energy in the United Arab Emirates is the national initiative titled 'A Green Economy for Sustainable Development', announced in 2012. It demonstrates the ambition to become one of the global leaders in green products and technologies. However, the UAE Green Agenda Programs (2015–2030), among others, focus on mega solar PV projects, advancing concentrated solar power (CSP). Adopted in 2017, the National Climate Change Plan of the United Arab Emirates 2050 focuses on economic diversification.

All 3SI countries are members of the European Union. Therefore, one should consider the EU's central regulations aimed at the transition to green energy, which is the 'European Green Deal' presented in December 2019. In its implementation, in July 2020, the European Commission published 'A hydrogen strategy for a climate-neutral Europe', emphasizing green hydrogen, which is to be fully zero-emission in the EU by 2050. A year later, the next significant package of climate regulations became 'Fit for 55', assuming the achievement of climate neutrality by 2050. In May 2022, EU member states presented 'REPowerEU: affordable, secure, and sustainable energy for Europe to dynamically accelerate the energy transformation. Moreover, all Three Seas Initiative countries have adopted or are developing detailed regulations at the national level that have been analyzed in this research. In the context of the development of works on hydrogen, as one of the priority future energy sources, on 7 December 2021, Poland announced the 'Hydrogen Strategy until 2030 with an Outlook until 2040'. Poland is the third largest producer of hydrogen in the European Union and fifth in the world.

This manuscript is the first study on the UAE's green economy with all 3SI countries. So far, no author has touched upon this issue. Therefore, it fills the research gap in the international literature.

2.2. Research Methodology

The study took inductive reasoning, moving from concrete observations to identifying behavioral patterns that allow hypotheses to be made through broader generalizations and theories, called a bottom-up approach [4] (p. 23). The author had the opportunity to investigate the research through ten-year participation in many processes and phenomena of the studied area, including as Ambassador and Senior Advisor to Dubai Expo 2020, responsible for dynamizing the 3SI countries in the relations of the UAE. To find the answers to the research questions, the manuscript design is based on quantitative analysis and methods with a descriptive study. To achieve the article's aim, the author applied case studies and trend analysis. Therefore, the research subjects, which are the 3SI countries and the UAE, were tested to identify the relationships between the high-level visits and trade variables.

Due to the novelty of the presented article, the collected research material is based mainly on information from government institutions of the investigated countries. Then, this pool was analyzed, critically assessed, and compared. However, this was only fragmentary and scattered data. Therefore, the author ordered, categorized, and generalized, subjecting them to statistical analysis. The Pearson correlation coefficient formula: $r = \frac{\sum((X - Mx)(Y - My))}{\sqrt{(\sum SSx)(\sum SSy)}}$ was applied to test the direction and strength of the high-level visits' impact on trade exchange [5] (p. 473). Section 5 demonstrates findings in trade and bilateral visits during 2010–2020. Regular visits have been identified as $5 \geq$ top visits and $3 \leq$ years break. However, non-regular have $4 \leq$ years break. Results were developed, contributing to the research area in question. Case studies with trend analysis in Section 6 provided predictions of causal relationships and a description of characteristics.

3. The United Arab Emirates Green Economy

In 2010, the United Arab Emirates announced the Vision 2021 Strategy, focusing on moving away from oil as the primary source of income. In January 2012, the UAE launched the 'green economy for sustainable development'. It aims to create a new global model and to become a world leader in defining trends, programs, and international standards. Moreover, the UAE wants to be a significant producer of innovative green technologies. Another goal of this initiative is the construction of urban facilities that are friendly to people and the environment. One of the examples of its implementation is the Smart Dubai program, based on digital transformation [6]. The next goal is to manage water and energy sustainably. Moreover, the strategy focuses on promoting organic farms and protecting biodiversity and ecological balance. Other program elements are recycling waste and reducing the consequences of climate change (Figure 1). In 2014, the UAE organized the Abu Dhabi Ascent to promote a green economy, energy transformation, and renewable energy investments. The same year in September, the United Arab Emirates established the Mohammed bin Rashid Center for Government Innovation and adopted the National Innovation Strategy. Renewable energy and research on clean technologies and transport based on innovative solutions for sustainable development have become its priorities [7] (p. 213).

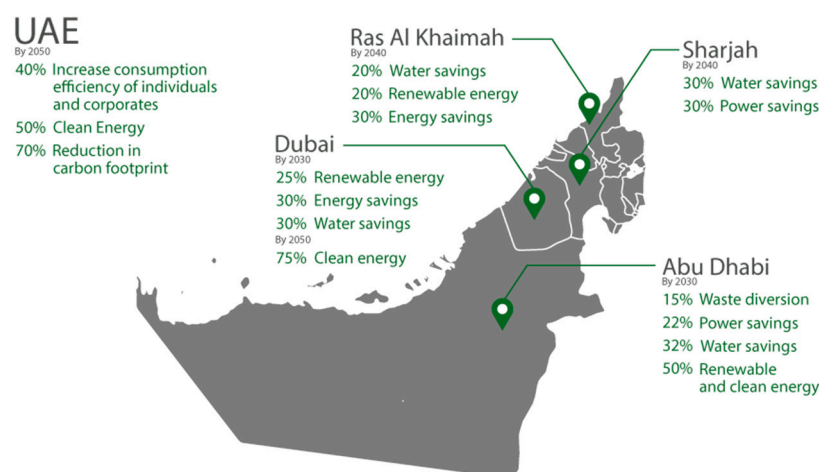


Figure 1. The United Arab Emirates—Sustainability Initiatives (source: EmiratesGBC [8]).

Consistently striving to implement a green economy and energy transformation, in 2015, the UAE government adopted the National Strategy for Green Growth (NGGS), which gave Vision 2021 a new impulse. In 2016, the United Arab Emirates set up the Council on Climate Change and the Environment to create cooperation between the government and the private sector to mitigate climate change effects [9] (pp. 47–48). Then, in 2017, the UAE established the National Committee for Sustainable Development Goals and launched the National Committee for SDGs to develop public-private partnerships for a green economy. During the World Government Summit in Dubai in 2018, the Global Council for SDGs was established, with the UAE Minister of State for International Cooperation as the chairperson. This initiative aims to build a multi-level and multi-dimensional network of cooperation between governments, international organizations, non-governmental organizations, and the world of science and business [10] (p. 9).

4. Three Seas Initiative

The European Union focused on East–West development. However, the North–South connection and energy corridors were neglected. Therefore, Central and Eastern European nations decided to develop cooperation comprehensively [11]. With the initiative of Croatia and Poland, during the first summit in Dubrovnik in 2016, the Three Seas Initiative was formally launched. 3SI has become the new platform for deeper cooperation on energy, transport, digitization, and the economy as priorities between 12 countries (Austria, Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia), located between the Adriatic–Baltic–Black Sea (Figure 2). The Three Seas Initiative can be recognized as the implementation of the ‘New Europe’ concept. Moreover, this project reflects the historical *Intermarium* idea, the geopolitical federation of independent states in Central and Eastern Europe [12] (p. 82).

In 2017 at the 3SI summit in Warsaw, the President of the USA underlined the Three Seas Initiative’s strategic significance, especially for energy transformation. The President of Croatia noted that the liquefied natural gas (LNG) terminal on the Croatian island Krk will provide strategic energy independence. The corridor construction with Poland and interconnectors towards Hungary and Ukraine will support energy sovereignty and will be an added value to the entire region. In 2019, Budapest informed about its willingness to import LNG from Qatar via the Croatian terminal [13]. Hence, in 2020, Power Globe Qatar LLC decided to deliver 10.1 bcm from January 2021 to September 2035. It was crucial for the implementation of this project to diversify gas supplies to Central and Eastern Europe [14]. On January 29, 2021, as part of the Energy Connectivity initiative, a new LNG terminal, including a pipeline, became a priority for the EU [15] and a crucial element of the Three Seas Initiative regarding energy.



Figure 2. The Three Seas Initiative’s countries (source: Garding, Mix [16]).

5. Top Visits and Green Trade Exchange Case Studies

For the United Arab Emirates, agreements on economic cooperation have become an essential element of international relations and trade. Therefore, the UAE has signed agreements with about 70 countries, including most 3SI countries, establishing a Joint Economic Committee (JEC), focusing on green economy and energy transformation. The trade between the UAE and the countries of the Three Seas Initiative does not include oil. Following the UAE Strategy Vision 2021, which underlines moving away from oil as the primary source of income, Central and Eastern Europe gained much more significance in the United Arab Emirates’ foreign and economic policy. Analyses of 3SI twelve countries and their crucial bilateral visits show that in the last 20 years, each has recorded a visit at the highest level in relations with the UAE. The charts below present GDP (Figure 3), trade dynamics, and the most significant bilateral visits. Meetings at the level of heads of state and government, ministers of foreign affairs, the economy, and members of the royal family with high state positions were considered.

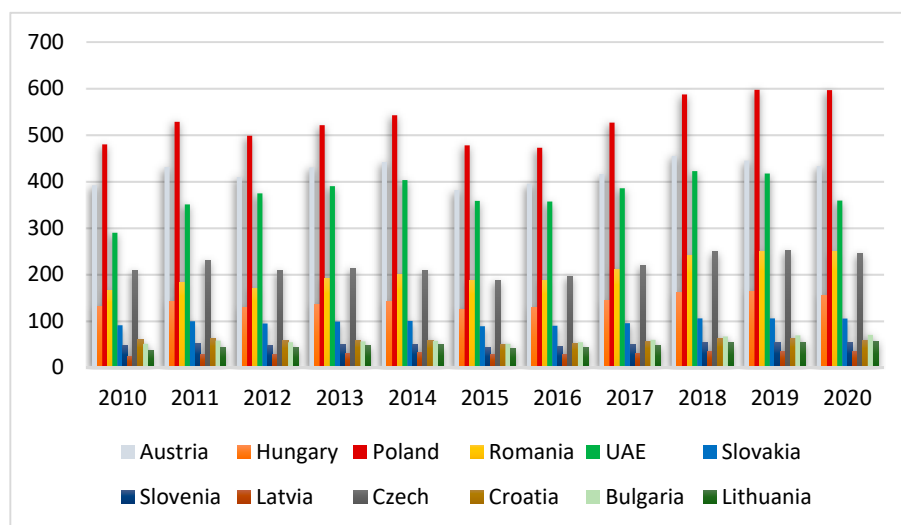


Figure 3. GDP in USD billion. Based on the World Bank data [17].

5.1. Trade and Regular Bilateral Visits between the 3SI Countries and the UAE

5.1.1. Austria

Compared to other Three Seas Initiative countries, Austria has the lengthiest diplomatic relations with the UAE, established in 1974. However, after the 3SI launch, the cooperation increased. In May 2017, the Austrian Chancellor came to the UAE, focusing on trade and energy. In November, the JC took place in Vienna, signing the agreement on energy technologies. At the beginning of 2018, the UAE Minister of Foreign Affairs and International Cooperation came to Austria. In April, the Austrian Chancellor visited the UAE [8]. The research findings (Figure 4) and the calculation:

$$X \text{ Values: } \sum = 9; \text{ Mean} = 0.818; \sum(X - Mx)^2 = SSx = 11.636$$

$$Y \text{ Values: } \sum = 12107; \text{ Mean} = 1100.636; \sum(Y - My)^2 = SSy = 612940.045$$

$$X \text{ and } Y \text{ Combined: } N = 11; \sum(X - Mx)(Y - My) = 1503.273$$

$$R \text{ Calculation: } r = \frac{\sum((X - Mx)(Y - My))}{\sqrt{(SSx)(SSy)}}$$

$$r = 1503.273 / \sqrt{((11.636)(612940.045))} = 0.5629$$

demonstrate a moderate positive correlation and a tendency for higher variable scores.

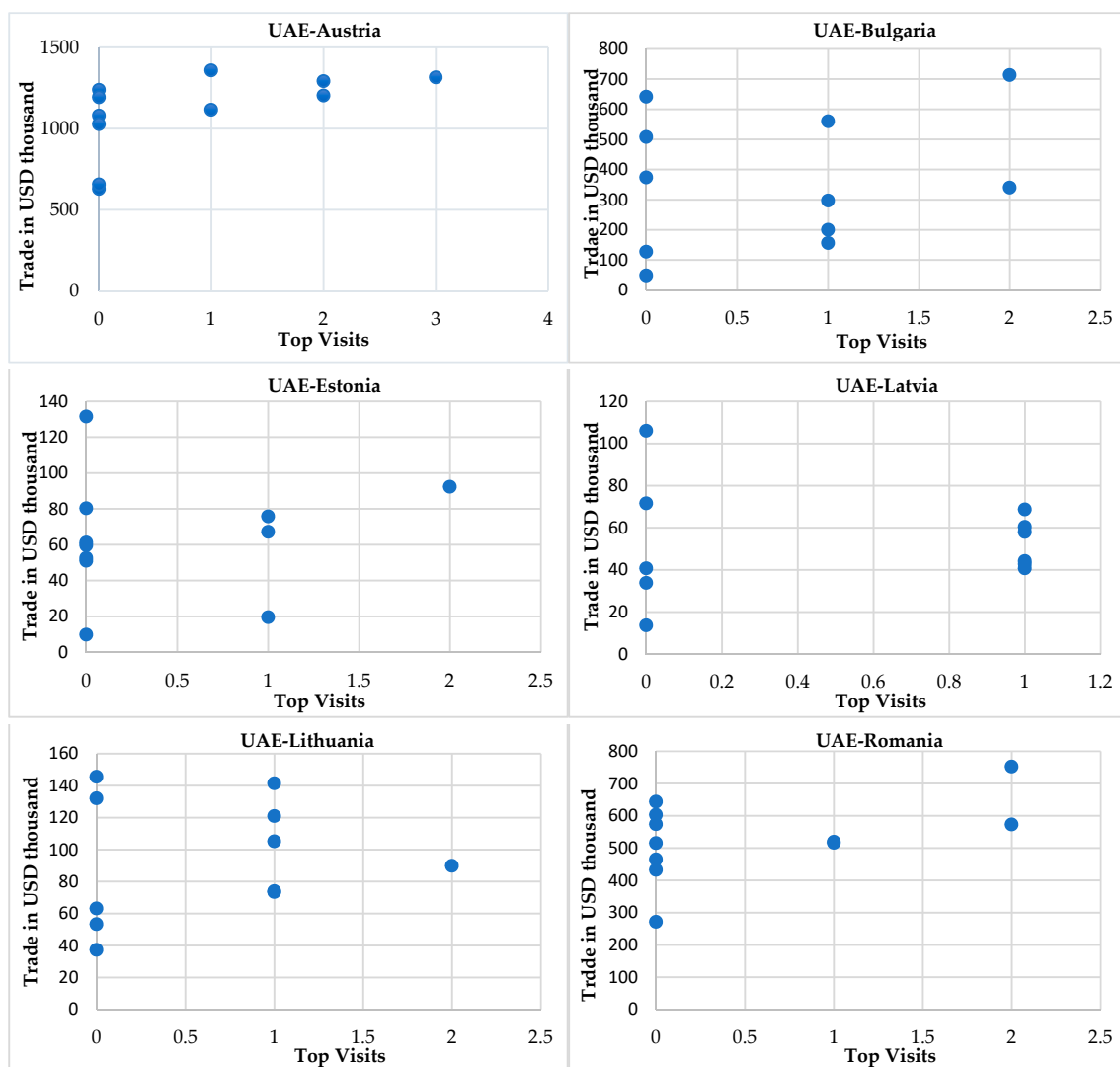


Figure 4. A correlation between the variables.

5.1.2. Bulgaria

In January 2016, the relationship started to develop when the Bulgarian Minister of Information Technology came to the UAE. In response, in October, the UAE Minister of Economy visited Bulgaria to sign an economic agreement establishing the JEC. Consequently, the following year, his Bulgarian counterpart came to the UAE. In April 2018, the Bulgarian Deputy Prime Minister visited the UAE, inaugurating the Embassy in Abu Dhabi. In October, the Prime Minister of Bulgaria visited the UAE to develop cooperation in organic food. In June 2019, the UAE Minister of Foreign Affairs and International Cooperation in Bulgaria presented the strategic partnership and opened the Embassy in Sofia. In February 2020, the Bulgarian Deputy Prime Minister visited the United Arab Emirates to support SMEs and create a joint venture [17]. Study (Figure 4) and the calculation:

$$X \text{ Values: } \sum = 8; \text{ Mean} = 0.727; \sum(X - M_x)^2 = SS_x = 6.182$$

$$Y \text{ Values: } \sum = 3966.4; \text{ Mean} = 360.582; \sum(Y - M_y)^2 = SS_y = 488632.216$$

$$X \text{ and } Y \text{ Combined: } N = 11; \sum(X - M_x)(Y - M_y) = 436.345$$

$$R \text{ Calculation: } r = \frac{\sum((X - M_x)(Y - M_y))}{\sqrt{(SS_x)(SS_y)}}$$

$$r = 436.345 / \sqrt{(6.182)(488632.216)} = 0.2511$$

show a positive correlation. However, the relationship between top visits and trade is weak due to the near-zero value.

5.1.3. Estonia

Relations were not intense until October 2015, when the Estonian Prime Minister came to the UAE to cooperate on smart cities. In May 2018, the UAE Minister of Economy visited Estonia. In response, in December, the Estonian counterpart came to Dubai. After a few weeks, the Prime Minister of Estonia visited the UAE to expand relations in AI. In September 2019, the Estonian President, with 70 businessmen came to the UAE to boost cooperation in IT [18]. The results (Figure 4) and the calculation:

$$X \text{ Values: } \sum = 5; \text{ Mean} = 0.455; \sum(X - M_x)^2 = SS_x = 4.727$$

$$Y \text{ Values: } \sum = 700.8; \text{ Mean} = 63.709; \sum(Y - M_y)^2 = SS_y = 11015.429$$

$$X \text{ and } Y \text{ Combined: } N = 11; \sum(X - M_x)(Y - M_y) = 28.555$$

$$R \text{ Calculation: } r = \frac{\sum((X - M_x)(Y - M_y))}{\sqrt{(SS_x)(SS_y)}}$$

$$r = 28.555 / \sqrt{(4.727)(11015.429)} = 0.1251$$

show a positive correlation. However, the relationship between the variables is weak, close to zero value. The top-level visits supported the trade, although it was not stable.

5.1.4. Latvia

The relations did not show any dynamics until March 2012, when the Latvian Prime Minister visited the UAE. Consequently, in March 2014, the UAE Minister of Foreign Affairs and International Cooperation came to Latvia, focusing on investment primarily in agriculture and organic food [19]. In June 2015, the Latvian Minister of Foreign Affairs visited the UAE to increase economic cooperation [20]. In May 2016, the Latvian Deputy Prime Minister arrived in the UAE to sign the agreement on economic and trade cooperation, establishing the JEC. Then, in February 2017, the Latvian President visited the UAE to set up an economic strategy. In May 2018, the UAE Minister of Economy came to Latvia. The first JEC took place in December 2019 in Abu Dhabi, identifying key sectors: trade and

investment, energy, renewable energy, and food, among others [18]. The research (Figure 4) and the calculation:

$$\begin{aligned} X \text{ Values: } \sum &= 6; \text{ Mean} = 0.545; \sum (X - M_x)^2 = SS_x = 2.727 \\ Y \text{ Values: } \sum &= 580.5; \text{ Mean} = 52.773; \sum (Y - M_y)^2 = SS_y = 5879.882 \\ X \text{ and } Y \text{ Combined: } N &= 11; \sum (X - M_x)(Y - M_y) = -1.936 \\ R \text{ Calculation: } r &= \frac{\sum ((X - M_x)(Y - M_y))}{\sqrt{(SS_x)(SS_y)}} \\ r &= -1.936 / \sqrt{(2.727)(5879.882)} = -0.0153 \end{aligned}$$

show that despite a negative correlation, the relationship between the variables is only weak, close to zero value.

5.1.5. Lithuania

Relations were not advanced until May 2012, when the Lithuanian Minister of Foreign Affairs visited the UAE. The Emirati counterpart came to Vilnius in June 2014, focusing on investments and sustainable economic development. Consequently, in 2015, the Lithuanian Minister of Economy visited the UAE. In July 2017, the UAE Minister of Foreign Affairs and International Cooperation paid a visit. A crucial impulse for green economy relations was the Lithuania President's visit with a large business delegation to the UAE in November 2017. The partners discussed cooperation in solar panels produced in Lithuania, one of the most efficient in the world. The country has a 10% share in the global market [3]. Moreover, both countries have identified potential for trade in organic agriculture. In May 2018, the UAE Minister of Economy visited Lithuania to expand cooperation. In March 2020, the Lithuanian Minister of Foreign Affairs came to the UAE, where he opened the Embassy, the first in the region. The study (Figure 4) and the calculation:

$$\begin{aligned} X \text{ Values: } \sum &= 7; \text{ Mean} = 0.636; \sum (X - M_x)^2 = SS_x = 4.545 \\ Y \text{ Values: } \sum &= 1035.8; \text{ Mean} = 94.164; \sum (Y - M_y)^2 = SS_y = 13862.905 \\ X \text{ and } Y \text{ Combined: } N &= 11; \sum (X - M_x)(Y - M_y) = 35.255 \\ R \text{ Calculation: } r &= \frac{\sum ((X - M_x)(Y - M_y))}{\sqrt{(SS_x)(SS_y)}} \\ r &= 35.255 / \sqrt{(4.545)(13862.905)} = 0.1404 \end{aligned}$$

demonstrate a positive correlation. However, the relationship between the variables is weak, close to zero value.

5.1.6. Romania

Two top-level visits from Romania took place to UAE in the 1990s: in May 1991, the Prime Minister, and in April 1993, the President. In February 2002, the Romanian President came to the UAE again. Consequently, in November of the next year, Dubai Ports World company received a license to operate the Constanta South Container Terminal (CSCT). In May 2015, the Romanian Prime Minister visited the United Arab Emirates. In January 2016, the Chemie-Tech DMCC group from the UAE informed about a will to invest USD 63 million in Romania's recycling used oil collection network [21]. In April 2018, the first JEC was held in Bucharest. In September, the Abu Dhabi ruling family member came to Romania. A month later, the Romanian Prime Minister arrived in the UAE, focusing on green energy, logistics, and concluding a Strategic Economic Partnership. Consequently, DP World, in March 2019, received the license extension to manage the CSCT until 2049. It has a strategic significance for the 3SI road project via Carpatia, offering a quick connection to the CEE, the Middle, and the Far East. In June, the UAE Minister of Foreign Affairs and International Cooperation came to Romania to review strategic cooperation [22]. The

results show (Figure 4) that the trade exchange is stable. The correlation between top visits and trade is a weak positive correlation:

$$X \text{ Values: } \sum = 6; \text{ Mean} = 0.545; \sum(X - M_x)^2 = SS_x = 6.727$$

$$Y \text{ Values: } \sum = 5863.7; \text{ Mean} = 533.064; \sum(Y - M_y)^2 = SS_y = 152385.305$$

$$X \text{ and } Y \text{ Combined: } N = 11; \sum(X - M_x)(Y - M_y) = 486.918$$

$$R \text{ Calculation: } \sum((X - M_x)(Y - M_x)) / \sqrt{(SS_x)(SS_y)}$$

$$r = 486.918 / \sqrt{(6.727)(152385.305)} = 0.4809$$

The Joint Economic Committee and the intensification of top-level visits contributed to the trade exchange.

5.2. Trade and Non-Regular Bilateral Visits between the 3SI and the UAE

5.2.1. Hungary

The first high-level visit took place in 1995 when the Hungary President came to the UAE. In June 2009, the UAE Minister of Foreign Affairs visited Budapest. Since 2015, relations gained more dynamics. In September, the UAE Minister of Economy came to Hungary to focus on the green economy [23]. In October, his Hungarian counterpart visited the UAE. Consequently, in March 2016, the first JEC took place in Dubai to develop cooperation in energy, environment, water management, and trade. Hence, the UAE Embassy was opened in Budapest in 2018, and in November, the Hungarian Minister of Foreign Affairs and Trade came to the UAE. In March 2019, the second JEC took place in Budapest, focusing on renewable energy and trade [24]. The research (Figure 5) and the correlation value is a negative:

$$X \text{ Values: } \sum = 5; \text{ Mean} = 0.455; \sum(X - M_x)^2 = SS_x = 4.727$$

$$Y \text{ Values: } \sum = 8806.6; \text{ Mean} = 800.6; \sum(Y - M_y)^2 = SS_y = 3577435.66$$

$$X \text{ and } Y \text{ Combined: } N = 11; \sum(X - M_x)(Y - M_y) = -1637$$

$$R \text{ Calculation: } r = \sum((X - M_x)(Y - M_x)) / \sqrt{(SS_x)(SS_y)}$$

$$r = -1637 / \sqrt{(4.727)(3577435.66)} = -0.3981$$

However, it is only weak because the result is close to zero.

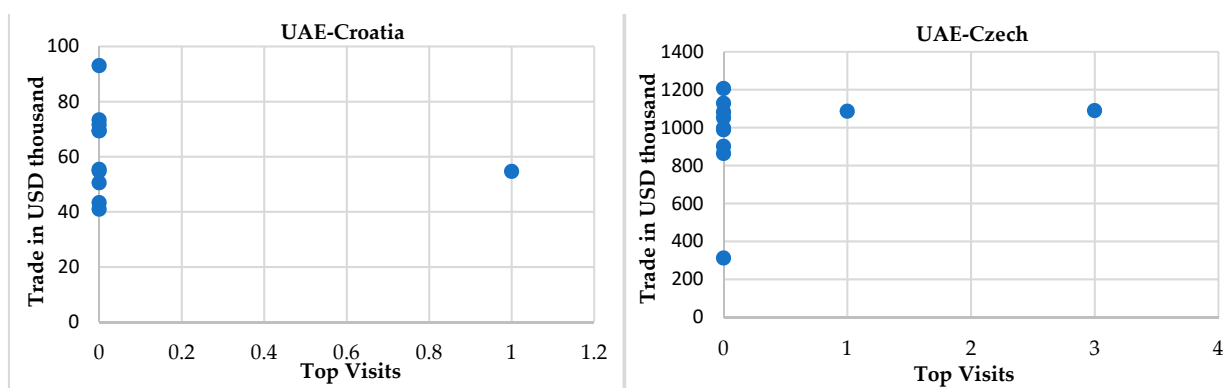


Figure 5. Cont.

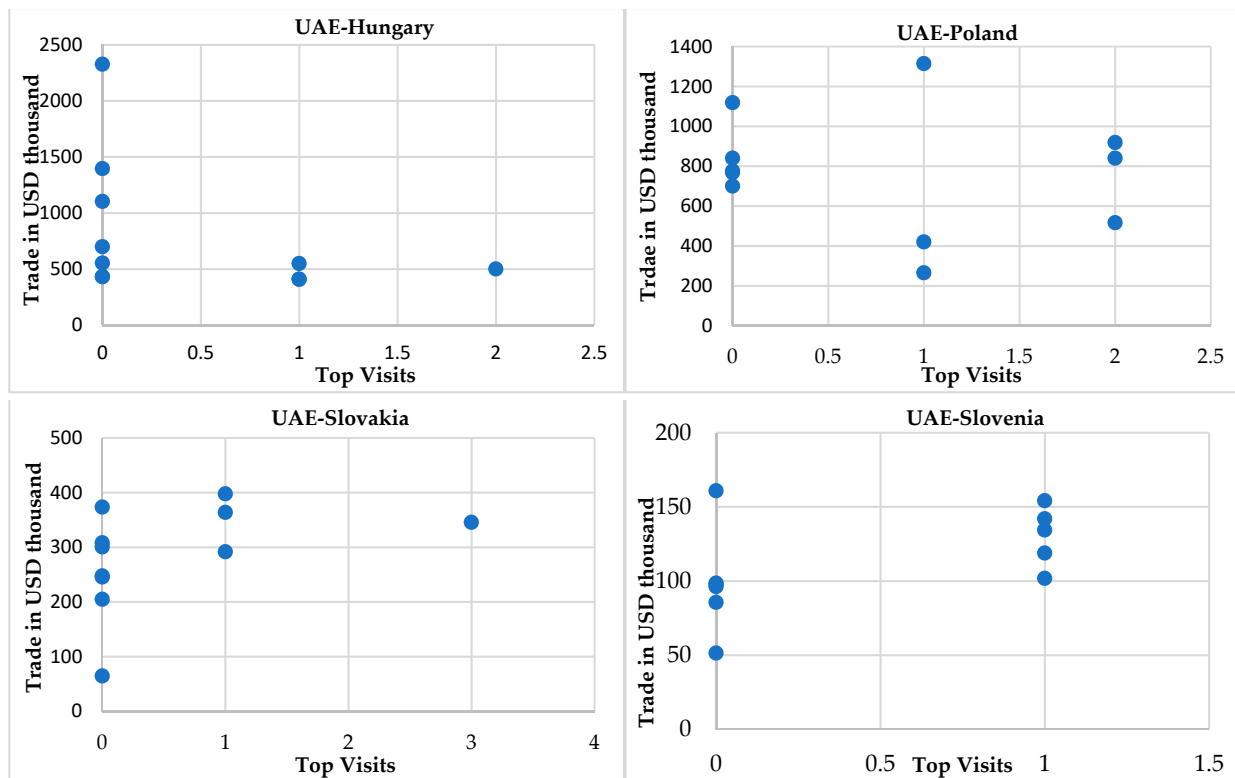


Figure 5. A correlation between top visits and trade.

5.2.2. Poland

Relations accelerated in 2011, and until 2015, the highest trade level to date took place, supported by an unprecedented number of visits. In May 2011, the first visit to Poland by the UAE Minister of Foreign Affairs. In January 2012, the Polish Deputy Prime Minister took part in the energy summit in Abu Dhabi, during which the UAE launched the 'green economy for sustainable development'. Two months later, during the Polish Prime Minister's visit to the UAE, an economic agreement was signed, establishing the JEC, and in February 2013, in Poland, the first JEC. The first meeting was held in Poland in February 2013, focusing on the green economy. In December, the President of Poland paid a visit to the UAE, and a few months later, the UAE Minister of Foreign Affairs came to Poland. In April 2015, the UAE hosted the second JEC. Two months later, the Vice President, Prime Minister, and the Ruler of Dubai came to Poland [25]. However, no meeting of the JEC took place after 2015. The study demonstrates a negative correlation:

$$X \text{ Values: } \sum = 9; \text{ Mean} = 0.818; \sum (X - M_x)^2 = SS_x = 7.636$$

$$Y \text{ Values: } \sum = 8478.2; \text{ Mean} = 770.745; \sum (Y - M_y)^2 = SS_y = 895840.167$$

$$X \text{ and } Y \text{ Combined: } N = 11; \sum (X - M_x)(Y - M_y) = -386.509$$

$$R \text{ Calculation: } r = \frac{\sum ((X - M_x)(Y - M_y))}{\sqrt{(SS_x)(SS_y)}}$$

$$r = -386.509 / \sqrt{(7.636)(895840.167)} = -0.1478$$

Nevertheless, the relationship between the variables is only weak due to the near-to-zero value.

5.2.3. Slovakia

Until the Slovak Embassy in Abu Dhabi was re-opened in 2013, relations were not very dynamic. In June 2014, the Deputy Prime Minister of Slovakia visited the UAE. In April 2015, the UAE Minister of Economy came to Slovakia, and an MoU on establishing a JEC was signed to develop cooperation on the green economy and trade. In December 2015, the Slovak Prime Minister visited the UAE. In July 2017, the UAE Minister for Foreign Affairs first time came to Slovakia. In April 2018, the UAE Deputy Prime Minister with the Mubadala, Fly Dubai, and Etihad Airways representatives came to Slovakia [20]. The results (Figure 5) and the calculation:

$$X \text{ Values: } \sum = 6; \text{ Mean} = 0.545; \sum(X - M_x)^2 = SS_x = 8.727$$

$$Y \text{ Values: } \sum = 3141.6; \text{ Mean} = 285.6; \sum(Y - M_y)^2 = SS_y = 89100.58$$

$$X \text{ and } Y \text{ Combined: } N = 11; \sum(X - M_x)(Y - M_y) = 375.2$$

$$R \text{ Calculation: } r = \frac{\sum((X - M_x)(Y - M_y))}{\sqrt{(SS_x)(SS_y)}}$$

$$r = 375.2 / \sqrt{(8.727)(89100.58)} = 0.4255$$

demonstrate a positive correlation. However, the relationship between top visits and trade is weak due to zero value.

5.2.4. Slovenia

Relations were not dynamic until the first ever visit of the UAE's Minister of Economy to Slovenia in September 2015. Both sides signed an economic agreement establishing the JEC and decided to focus on renewable energy, the environment, innovation, IT, and food. Consequently, in September 2016, the Slovenian Minister of Development and Technology, with about 200 businesses, came to the UAE, presenting the country as a gateway to the 3SI. In February 2017, the Prime Minister of Slovenia visited the UAE. The following year, Slovenia opened the Embassy in Abu Dhabi, the first in the Persian Gulf. The first JC chaired by the Foreign Ministers took place in the UAE in October 2019. The countries announced intensive cooperation in the green economy within the Green Group of six small countries, founded in 2009 by Slovenia with the UAE as a member. In addition, the partners agreed to establish permanent cooperation in AI. In January 2020, the Slovenian Deputy Prime Minister visited the United Arab Emirates again to deeper relations in renewable energy [8]. The research (Figure 5) and the calculation:

$$X \text{ Values: } \sum = 5; \text{ Mean} = 0.455; \sum(X - M_x)^2 = SS_x = 2.727$$

$$Y \text{ Values: } \sum = 1241.1; \text{ Mean} = 112.827; \sum(Y - M_y)^2 = SS_y = 10693.922$$

$$X \text{ and } Y \text{ Combined: } N = 11; \sum(X - M_x)(Y - M_y) = 86.764$$

$$R \text{ Calculation: } r = \frac{\sum((X - M_x)(Y - M_y))}{\sqrt{(SS_x)(SS_y)}}$$

$$r = 86.764 / \sqrt{(2.727)(10693.922)} = 0.508$$

underline a moderate positive correlation. It suggests a tendency for high variable scores.

5.2.5. Croatia

There were no advanced relations until July 2017, when the UAE Minister of Foreign Affairs and International Cooperation visited Croatia, focusing on the green economy, including energy. In April 2018, the business forum took place in Zagreb [8]. The study (Figure 5) and the calculation:

$$X \text{ Values: } \sum = 1; \text{ Mean} = 0.091; \sum(X - M_x)^2 = SS_x = 0.909$$

$$Y \text{ Values: } \sum = 676.2; \text{ Mean} = 61.473; \sum(Y - M_y)^2 = SS_y = 2364.622$$

$$X \text{ and } Y \text{ Combined: } N = 11; \sum(X - M_x)(Y - M_y) = -6.873$$

$$R \text{ Calculation: } r = \frac{\sum(X - M_x)(Y - M_x)}{\sqrt{(SS_x)(SS_y)}}$$

$$r = -6.873 / \sqrt{(0.909)(2364.622)} = -0.1482$$

show a negative correlation. Nevertheless, the relationship between the variables is weak due to the near-zero value.

5.2.6. The Czech Republic

Although trade was developing very well, high-level visits started in 2014. In March, the UAE Foreign Minister visited the Czech Republic focusing on sustainable economic development, renewable energy, and tourism. In February 2015, the Czech President came to the UAE to deepen cooperation in the green economy. Consequently, in April, the first Emirati economic mission took place in Prague, headed by the UAE Minister of Economy. In November 2015, his Czech counterpart came to the UAE. In July 2019, another Emirati economic delegation visited the Czech Republic focusing on the green economy, especially in smart cities, healthcare, tourism, and AI [14]. The results (Figure 5) and the calculation:

$$X \text{ Values: } \sum = 4; \text{ Mean} = 0.364; \sum(X - M_x)^2 = SS_x = 8.545$$

$$Y \text{ Values: } \sum = 10702.8; \text{ Mean} = 972.982; \sum(Y - M_y)^2 = SS_y = 577245.376$$

$$X \text{ and } Y \text{ Combined: } N = 11; \sum(X - M_x)(Y - M_y) = 461.073$$

$$R \text{ Calculation: } r = \frac{\sum(X - M_x)(Y - M_x)}{\sqrt{(SS_x)(SS_y)}}$$

$$r = 461.073 / \sqrt{(8.545)(577245.376)} = 0.2076$$

demonstrate a positive correlation. However, the relationship between top visits and trade is weak because the value is almost zero.

5.3. The Comparison among Countries

An analysis of the Three Seas Initiative countries shows that since 2010, all demonstrate a dynamic cooperation development with the United Arab Emirates. In most cases, it was supported by political and economic visits (Figure 6). From 2011–2015, Poland was a leader, especially after the announcement of the “green economy for sustainable development” program in 2012. During this period, Austria, Latvia, and Romania showed similar dynamics in the top visits. However, unlike Poland, those countries were continuing Joint Economic Committee meetings. Hungary, Slovenia, and Slovakia started JEC in 2015 when the 3SI was announced. Nevertheless, after 2016, Slovakia–UAE top visits decreased. Three Seas Initiative countries that did not have a JEC, Estonia, Lithuania, and Bulgaria, started a closer relationship with the UAE after the 3SI launch. The Czech Republic did not show top-level visits after 2015. However, trade was still high. Croatia recorded one high-level visit in 2017, and trade exchange with the United Arab Emirates after 2016 increased. There was no trade exchange in crude oil between 3SI countries and the UAE from 2010 to 2020. The exception was 2015 for Bulgaria and 2018 for Poland, when they imported a small amount of this raw material. Trade after the 3SI launch increased in all countries except Hungary and Romania (Figure 7).

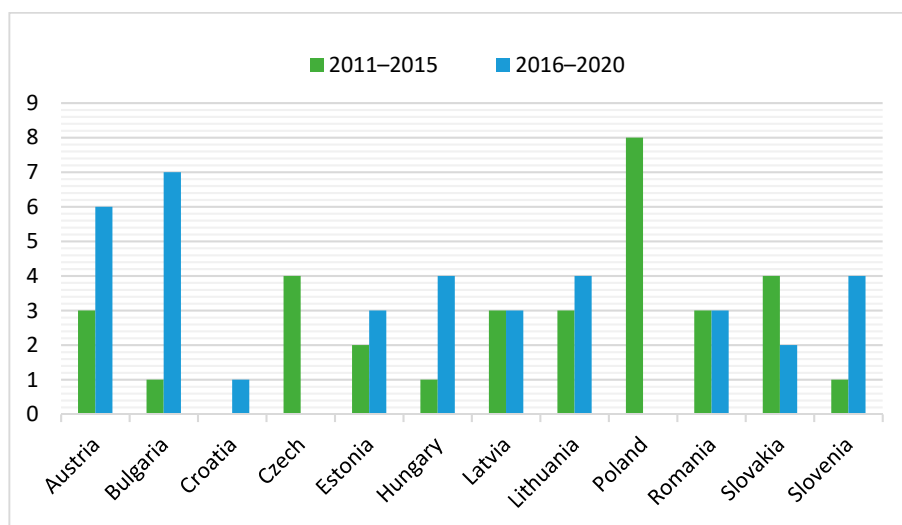


Figure 6. Top bilateral visits 3SI countries-UAE. Data based on the MOFAiC [26].

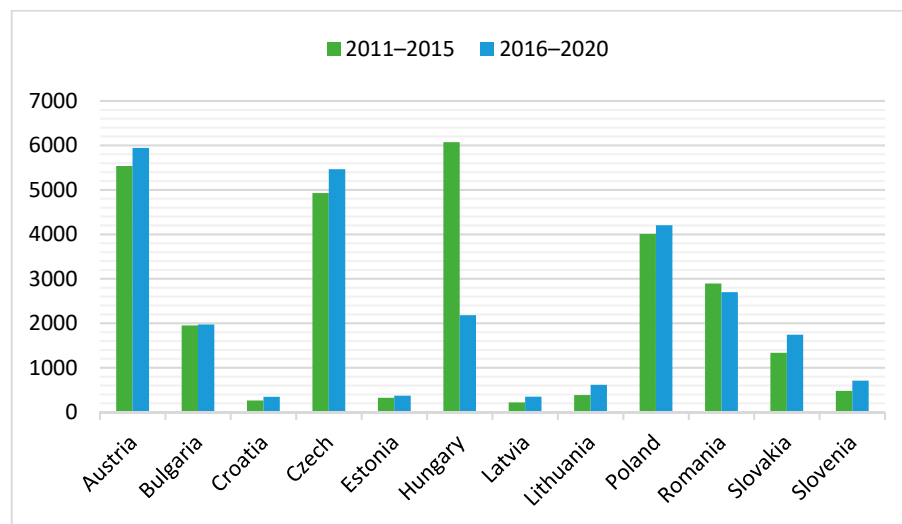


Figure 7. Green trade (USD thousand) in comparison before and after 3SI. Based on MoE data [27].

6. Trend Analysis for Energy Transformation and Green Economy

6.1. Discussion: General Perspective

The United Arab Emirates is a top Gulf country initiating renewable energy projects that began in 2006 with Masdar Company and Masdar City, the region’s first sustainable city. Since 2009, Abu Dhabi has been the International Renewable Energy Agency (IRENA) headquarters [28] (p. 4). Central and Eastern Europe relations with the UAE are gaining momentum, with all sides pursuing strategies to diversify alliances and sources of income. It has been happening since the UAE initiated the green economy program in 2012. Moreover, the United Arab Emirates relations have intensified with most CEE countries following the initiation of the Three Seas Initiative. Although oil remains significant in the UAE federal budget revenues (Figure 8), efforts are being made to become independent from this raw material, including in relations with 3SI countries.

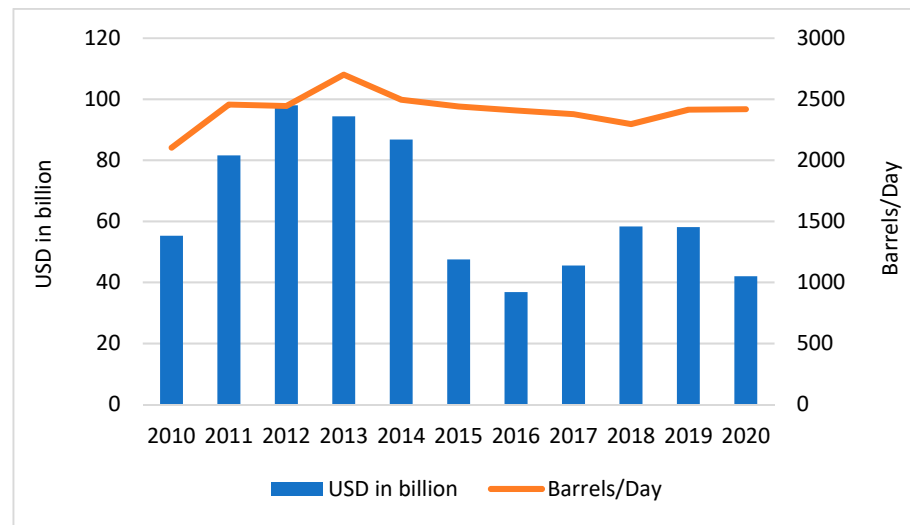


Figure 8. The UAE’s energy trade: crude oil export. Based on the CEIC data [29].

Most of the UAE oil was exported to Asia. Almost the whole of Europe, especially 3SI countries, were not recipients of it (Figure 9). Based on Autoregressive Distributed Lag (ARDL), AlKhars, Miah, Qudrat-Ullah, and Kayal underline that economic growth is related to energy consumption in the United Arab Emirates [30] (p. 15). Critically judging, one should agree with the results of the Jaradat and Al-Tamimi research (also based on the ARDL)—that there is a statistically significant relationship between renewable energy and the economy in the United Arab Emirates [31] (p. 161).

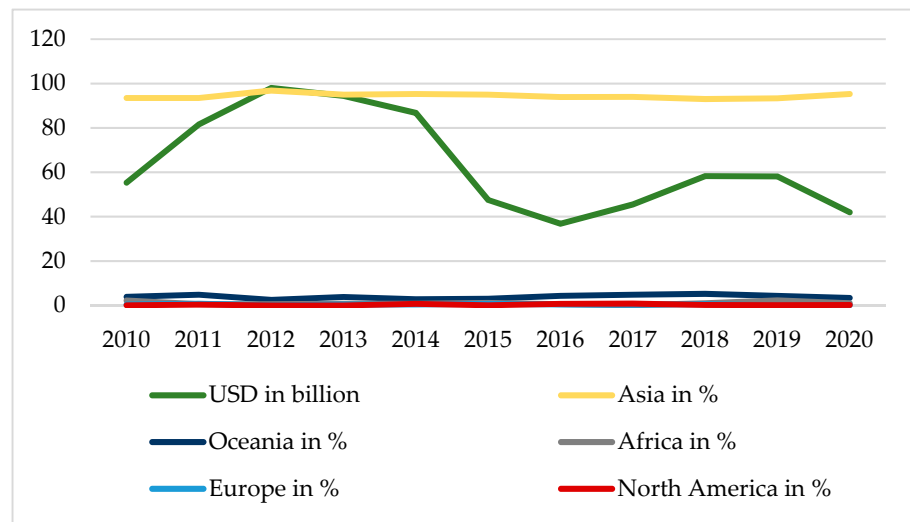


Figure 9. The UAE’s energy trade: crude oil export destination. Based on the OEC data [32].

The UAE is investing heavily in renewable energy, primarily solar energy. In 2013, the United Arab Emirates ranked third in the world in concentrated solar power (CSP) production. At that time, Shams 1 launch was one of the most global broad CSP facilities and the first commercial solar project in the Middle East. By the end of 2022, the biggest solar power plant in the world, called Al Dhafra Solar PV, should be completed in Abu Dhabi by the Emirates Water and Electricity Company. It will be able to reduce CO₂ emissions by 2.4 million metric tons per year. For comparison, it is around half a million car emissions. The research carried out supports the opinion of Tehreem, Mentel, Doğan, Hashim, and Shahzad—that these factors require reforms that promote economic and export diversification to increase the share of non-oil production. However, critically

judging, energy consumption and trade are steadily increasing [33] (p. 8400). Another concentrated solar energy project under development, based on the IPP model, is Mohammad Bin Rashid Al Maktoum Solar Park. It aims to become the world's largest single-site CSP by 2030, reducing CO₂ emissions by 6.5 million tons per year and providing energy for less than 8 US cents per kilowatt-hour. The Dubai Clean Energy Strategy 2050 will contribute to the increase of green energy in the total electricity production in Dubai to 75%. Samour, Baskaya, and Tursoy confirm the conclusions of the study—that FDI, economic, and financial development have a significant role in renewable energy consumption in the UAE both in the short and long term [34] (pp. 10–11).

As also noted by Naqbi, Tsai, and Mezher [28] (p. 2), the UAE's target for a 7% renewable energy share by 2020 has already been achieved. Another goal is 25% by 2030 and 44% by 2050. These aims are served by extensive investments in solar technologies, photovoltaic and solar concentration systems, energy efficiency, storage systems, and a smart grid. These initiatives offer the opportunity for energy transformation from an economy based on fossil fuels to a leader in green economy and energy diversification. Therefore, the UAE has been exploring alternative ways of financing these areas. In this context, the United Arab Emirates with the United Nations Development Program founded the World Green Economy Organization (WGEO), which aims to support the green economy by combining funding, technology, and business.

In 2016, Dubai Electricity and Water Authority established the Dubai Green Fund, with around EUR 24 billion for environmental projects. The First Abu Dhabi Bank (FAB) in March 2017 issued the region's first five-year green bond worth USD 587 million. In addition, the FAB has earmarked USD 10 billion to finance green businesses over ten years. In October of the same year, the Masdar company signed an agreement with First Abu Dhabi Bank, Société Générale Corporate and Investment Banking, Japanese international banking, Sumitomo Mitsui Banking Corporation, and UniCredit on the Middle East's first green revolving credit facility. In 2017, the UAE with Lithuania, and Slovenia, were among the 10 new players entering the green bond market. Critically judging, Salimi, Hosseinpour, and Borhani's SWOT analysis confirm this research finding of the importance of solar energy technologies, including photovoltaic (PV) and CSP, to the energy transition in the UAE. The findings show that the construction of solar power plants should be supported by further investments and green financing [35] (p. 14). By 2030, the United Arab Emirates, among GCC countries, is expected to have the largest capacity for integrated photovoltaic installation in public buildings [36] (p. 14). Ramachandran, Mourad, and Hamed confirm the conclusions of the study. Moreover, within the GCC, the United Arab Emirates is a leader in renewable energy production, especially solar, including photovoltaics and CSP. The UAE government also sponsors various solar projects outside of the UAE. Private companies are also developing in the field of solar energy, including trade, assembly, and production of thermal collectors and mirrors with photovoltaic panels. These companies can be engaged in future photovoltaic projects [37] (p. 22–23).

The United Arab Emirates based on solar power may, in the future, become an exporter of hydrogen to Europe. The EU is interested in creating a global hydrogen market and facilitating production and trade. The United Arab Emirates wants to become a global clean energy house and the initiator of the pursuit of net-zero carbon dioxide emissions by 2050. However, in June 2020, the UAE discovered one of the world's largest natural gasses in the last 15 years. As of November 2020, the United Arab Emirates has become the newest global producer of unconventional gas, i.e., coal gasification slag (CGS). In early 2021, the UAE decided to produce blue and green hydrogen based on an Abu Dhabi Hydrogen Alliance. It includes Mubadala Investment Company (Mubadala); Abu Dhabi National Oil Company (ADNOC) and ADQ (a major shareholder of Abu Dhabi National Energy Company PJSC—TAQA) [38].

From 6 to 17 November 2023, UAE will be the organizer of the 28th Conference of the Parties (COP28). It will be an opportunity to demonstrate the UAE Net-Zero by the 2050 Strategic Initiative announced in early 2021 and other UAE achievements in mitigating

the consequences of climate change. In addition, the United Arab Emirates will be able to promote green economic growth and energy transformation.

6.2. Three Seas Initiative Countries—The United Arab Emirates Perspective

In the current unstable geopolitical situation, the European Union is accelerating investments in renewable energy. This applies primarily to Central and Eastern Europe and the Three Seas Initiative, all of which are EU members. In May 2022, the European Union presented a new initiative to accelerate the implementation of the energy transformation [39]. On 14 September 2022, in the European Parliament, during the annual State of the Union Address, the European Commission President, as part of the energy transition, announced the establishment of the European Hydrogen Bank, with an amount of EUR 3 billion to invest in hydrogen technologies [40]. These initiatives are related to the ‘European Green Deal’ [41], presented in December 2019; ‘A hydrogen strategy for a climate-neutral Europe’, published in July 2020 [42]; and the ‘Fit for 55’ climate regulation package of July 2021 [43]. In addition, since June 2022, Ukraine has had a participating state status in 3SI. Moreover, the United Arab Emirates has dynamically developed relations and trade with these countries in recent years. The Black Sea ports, including Constanța in Romania and Odessa in Ukraine, are managed by the company from Dubai DP World.

6.2.1. The Baltic States

In September 2021, the Estonian Minister in Abu Dhabi called on others to increase cooperation in renewable energy and artificial intelligence. The research confirms Griffiths’ claim that AI is essential for the digitization and integration of renewable energy technology into the energy sector, supporting the intelligent transport system and reducing the cost of oil production in the UAE in the long term [44] (p. 9). Critically judging, Lu, Ren, Yao, Qiao, Strielkowski, and Streimikis’s findings confirm the conclusions of this study—that sustainable energy development trends in the Baltic States demonstrate growth [45]. Estonia, with Latvia, is working on a joint offshore wind farm in the Gulf of Riga, which is the first of its kind European cross-border infrastructure project. The farm should provide 1 GW (gigawatt) of clean energy or 3 TWh (terawatt hours) of renewable energy. It will be located more than 15 km from the seashore, ensuring that the biodiversity is not affected. Latvia already has the necessary energy infrastructure for renewable energy and trading electricity with its Nordic neighbors through the Kurzemes Loks project, which connects the Nordic and Baltic energy markets with a NordBalt underwater power cable. Latvia is the second greenest country in the European Union regarding CO₂ emissions and the third-largest producer of renewable energy in Europe. Overall, 41% of the energy consumption comes from green energy, thanks to hydroelectric energy based on a network of numerous rivers. The Latvian Baltic Sea coast, which accounts for around 50% of the country’s border, can generate up to 1100 megawatts of renewable wind energy. Latvia has set the target to reach 50% renewable energy consumption by 2030. However, critically judging, this potential is not yet exploited. In March 2022, in Dubai, during the second JEC, Latvia and the UAE stressed the need for a partnership in renewable energy. They agreed on joint projects as a part of the transition to a greener economic model.

One of Lithuania’s priority goals is to accelerate renewable energy farms’ development so that the country will achieve energy independence by 2030. Agrokoncernas group plans to build three wind farms in Lithuania within the next three years, generating around 700–1000 MW (megawatt) of energy. More than half a million residential buildings can be supplied with electricity [46]. The group plans to invest EUR 1–1.4 billion in wind farms in three different regions of Lithuania. One of the strategic aims of this company is to contribute to the green energy revolution.

In January 2021, the Masdar and the Taaleri SolarWind II fund acquired 50:50 shares in two wind farms in Poland. One of them is Mława, with a capacity of 37.4 MW in northern Poland, and Grajewo, with 14 MW in the northeast. They will meet the energy demand of around 90,000 households and offset 146,000 tons of carbon dioxide each year. In December

2021, the wind farms were inaugurated [47]. Moreover, Poland is the third largest producer of hydrogen in the European Union. Planning to increase its position, in December 2021, Warsaw adopted the ‘Hydrogen Strategy until 2030 with an Outlook until 2040’ [48].

6.2.2. The Landlocked 3SI States

Austria, with the United Arab Emirates, signed a comprehensive strategic partnership in July 2021. Consequently, in March 2022, both countries signed a preliminary agreement on cooperation in hydrogen technology. It will contribute to the UAE’s world leadership in energy transformation. It is essential for a sustainable and diversified economy and will support the UAE to be an international model for the green economy. In February 2022, the Austrian SAN group announced that it would invest USD 3.3 million in building eco-friendly hydrogen and agricultural subsidiaries in the UAE’s Ras Al Khaimah economic zone. It is to be fully operational by the end of 2022. The partnership is expected to accelerate hydrogen use in utilities and industry. In addition, by implementing the energy transformation, the United Arab Emirates wants to become an exporter of hydrogen, having 25% of the global market share in the future. In December 2020, the Czech Republic economic mission to the UAE took place in Ras Al Khaimah. Both sides identified solar energy and innovation as areas with high investment potential [49]. In January 2022, the President of Slovakia paid a visit to Dubai for cooperation on the transition to a greener economy and hydrogen technologies. This is expected to revolutionize the private, public transport, and freight sectors [50]. In February 2022, within the third JEC, Hungary and UAE adopted a cooperation program, which covers, among others, trade, investment, water resource management, and renewable energy. In 2021, the value of non-oil trade between the UAE and Hungary was USD 272 million, an increase of 19% compared to 2020 and 26% compared to 2019 [51].

6.2.3. The Adriatic Sea States

In 2009, when environmental issues were not yet treated as a priority on the global agenda, Slovenia established the Green Group, which included six small countries from different continents, including the United Arab Emirates. It aims to promote the development of a green economy, renewable energy, and environmental protection. After 2010, investments in wind farms were treated as a priority for Zagreb. In 2017, nearly 30% of Croatia’s total energy was from renewable energy, mainly produced by hydropower plants. The Low-Carbon Development Strategy of the Republic of Croatia until 2030, with an outlook to 2050, adopted in February 2020, shows the main goals of the transition to low-emission energy. The current plans focus on the development of solar energy production [52] (p. 2). In March 2022, the Prime Minister of Croatia visited the UAE to ‘accelerate the ecological and energy transformation [53].’

6.2.4. The Black Sea States

Both in Bulgaria and the United Arab Emirates, the green economy is also being implemented with nuclear energy. The UAE owns the Barakah Nuclear Power Plant, which serves strategic energy transformation. It contributes to the reduction of CO₂ emissions by almost 21 million tons and supports green hydrogen. The energy market in Bulgaria is currently under transformation, and by 2030, nuclear energy may account for more than 40% of the total used energy [54]. Romania’s sustainable mix of energy resources and its relative energy independence reduce the risk of shortages in supply and contribute to a better response to climate change [55] (p. 2). In December 2021, the Romanian Senate representatives visited the UAE for cooperation in green and renewable energy. Both sides agreed to increase the participation of Romanian energy and water companies in joint projects and strategic cooperation. In March 2022, during the Expo 2020 in Dubai, the Business Forum was held with high-ranking officials and 50 of the most important Romanian companies to create joint partnerships and investment projects, including energy [56].

7. Conclusions

The studied research problem is the relationship of the United Arab Emirates with the countries of the Three Seas Initiative in the green economy. The 3SI and the UN Agenda 2030, were adopted in September 2015 in New York. The research focused on energy transformation, considering the reduction of the carbon footprint. To investigate its trends, the author collected and compared data for the Three Seas Initiative 12 countries in terms of trade and top visits to the UAE. Consequently, the researcher examined trends in new perspectives for green economy and energy transformation.

7.1. Research Contributions

This research is the first study on the United Arab Emirates and the 3SI countries in green economy and energy transformation. The results show that comparing the period from the beginning of the implementation of 3SI in 2016 until 2020 with the period 2010–2015, 9 out of 12 countries of the Three Seas Initiative had a significant increase in top-level meetings with the United Arab Emirates. On the other hand, 10 out of 12 states recorded a similar or higher level of trade after 2016. These increases took place despite the restrictions in 2020 related to COVID-19. High-level meetings influenced the growth in trade, but to a limited extent. The findings demonstrate that JEC, focusing on the green economy, supported the higher increase in trade. Seven out of twelve countries of the Three Seas Initiative by 2020 conducted the Joint Economic Committee. Until that year, only two of the 3SI countries recorded a negligible amount of oil trade. Moreover, the recent dynamic growth of projects and investments for energy transformation suggests that this area will become a priority. This process will be supported by the need to adapt the strategies of states and their economies to new geopolitical challenges and the effects of climate change.

7.2. Practical and Theoretical Implications

The presented research results have broad implications, both in practical and theoretical terms. For practitioners of international relations in the Three Seas Initiative countries and the United Arab Emirates, the findings should be valuable for the planning and implementation of projects. For theoreticians, this article's results should inspire other researchers to continue their in-depth analysis of the Three Seas Initiative in terms of its role and importance in relations with Middle Eastern partners.

7.3. Limitations and Future Directions

This research has some limitations. It does not have a detailed correlation analysis between the dynamics of top-level visits and energy investments in the green economy. The reason is that they started to implement it only in the current years, and hence there is a lack of appropriate empirical material. Therefore, this area should be researched in the future. Moreover, the future study should focus on searching for an answer to a new research question: to what extent can the United Arab Emirates and the Three Seas Initiative undertake joint projects for green economy and energy transformation in a multilateral dimension?

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