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Global Trends in Renewable Energy Adoption: A Data Analytics Approach for Sustainable Energy Planning

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ABSTRACT

Environmental and climate change issues, energy security and sustainable economic development are pushing the shift to renewables to the top of the global energy agenda. Although there have been considerable advances in renewable energy deployment, there are significant differences between countries. This study is focused on the worldwide developments of renewable energy consumption as a data analytics approach towards sustainable energy planning. To explore the connections between the adoption of renewable energy and relevant economic, environmental, technological and investment factors in various countries between 2018 and 2025 a quantitative analytical approach was used. Descriptive statistics, trend analysis, correlation analysis, multiple regression analysis, cluster analysis and forecasting analysis were used in the analysis to assess the level of adoption and the key factors. The results show that there is a steady rise in the use of renewable energy, with 39.42% of renewable energy being used in 2018 and increasing to 53.88% by 2025. The regression results show that the variables of renewable energy investment, policy support, technological readiness, grid readiness, and GDP per capita significantly and positively affect renewable energy adoption, while policy support has a negative effect. The study highlights the importance of a coordinated strategy that integrates data-driven decision-making, technological advancements, and investment planning to accelerate global energy transition. The results are meaningful for policy makers, energy planners, stakeholder groups that want to support sustainable development of energy and sustainable environmental and economic outcome in the long-term.

1. Introduction

The energy sector across the world is seeing a huge transformation in terms of solutions that can be adopted to replace the traditional energy system based on fossil fuels. The concerns on greenhouse gas emission, climate change and environmental degradation have been exacerbated by rapid industrialization, population growth, urbanization and rising energy needs. Renewable energy has become a key element in sustainable development plans to mitigate carbon footprints along with secure energy supply for the future (Alvan et al., 2026). The move to green energies, such as solar, wind, hydroelectric. Biomass and geothermal, are now firmly on the agenda of governments, international organisations and private investors to achieve the goal of climate neutrality and sustainable economic development.

The use of renewable energy sources not only supports environmental sustainability but also promotes economic resilience and social health. Developing the national energy system with renewable technologies has been shown to be a way of achieving lower reliance on imported fossil fuel resources, greater access to energy, and innovative economic development (Asif et al., 2024). Renewable energy deployment can be seen to provide positive economic results, along with a reduction in carbon emissions, which can contribute to the wider Sustainable Development and Climate change mitigation (CCM) goals (Bhattacharya et al., 2017). In addition, the increasing focus on cleaner energy systems is indicative of a greater awareness to consider balance between growth and the protection and conservation of the environment.

The adoption of renewable energy has been different in different countries in recent years. Developed economies have come a long way in recent years, using technological innovation, incentives and upgrading infrastructure; but other developing economies remain mired in financing, technological readiness and institutional capacity issues. The energy use of industry, transport and residential energy use are critical factors in the speed and success of renewables transitions (Bilgili, 2021). Therefore, it has become critical for policymakers and energy planners to grasp the determinants of the diffusion of renewable energy technologies to be able to develop effective policies for sustainable energy development.

In emerging economies, the growth of consumption of renewable energy has been spurred by various factors such as economic growth, technological advancements, policy support and environmental concerns. Studies on renewable energy futures have also emphasised the need to understand the drivers for and against the deployment of RE at the country level (Chen et al., 2022). Technological progress has been especially important, contributing to energy efficiency, renewables capacity and capability to integrate renewables into the grid. At the same time, as countries look to fulfill their international climate commitments and cut back their carbon footprints, investments have been increasing in cleaner energy systems due to rising environmental concerns.

While great strides have been made, there are still many obstacles to the widespread adoption of sustainable energy technologies. Financial constraints, infrastructure gaps, regulatory uncertainties, and technological barriers are key challenges that pose barriers to energy transition in several regions (Devadiga et al., 2026). These obstacles can only be overcome with evidence-based planning techniques that can inform areas for investment and enhance resource allocation. As a result, data analytics is becoming an important asset to assist in decision-making at strategic level in the energy industry. The complex relationships between the various economic, environmental and technological variables can be analyzed using advanced analytical techniques, which can then be used to provide actionable insights for sustainable energy planning (Leung et al., 2022).

Investment is also a key driver for climate change mitigation and sustainable development in renewable energy infrastructure investment. Greater investments in renewable energy have played an important role in renewable energy generation growth and in the lower greenhouse gas (GHG) emissions (Dilanchiev et al., 2024). Meanwhile, policy tools like feed-in tariffs, renewable portfolio standards, tax incentives and carbon pricing programmes have contributed to the growth and uptake of renewable energy and the involvement of the private sector (Döme, 2024). These policy frameworks have been effective, underscoring the need for effective governance arrangements to support successful energy transitions.

Studies in this area have also garnered increased academic interest in linkage between the adoption of renewable energy and sustainable economic performance. The relationship among cleaner energy systems, environmental quality, climate risks, and economic stability has been linked to better environmental quality, lower climate risks and greater economic stability, especially in fast-growing economies (He et al., 2023). Notwithstanding the growing research on renewable energy transitions, there is still significant variation between countries in terms of the rates of renewable energy adoption, levels of investment in renewable energy, and technological readiness. These disparities highlight the importance of thorough and global analytical perspectives that help to uncover the root causes of renewable energy uptake.

In view of these facts, the current study aims to explore the trend of renewable energy adoption through data analytics method to aid in sustainable energy planning globally. The study aims to understand the mechanisms of energy transition between countries by studying the correlation between the adoption of renewable energy and various economic, environmental, technological and demographic factors. \

2. Literature Review

2.1 Renewable Energy Adoption and Environmental Sustainability

The adoption of renewable energy has emerged as a cornerstone of global efforts towards sustainability, driven by its ability to significantly cut down on greenhouse gas emissions, boost energy security, and contribute to sustained economic growth. In recent years, a large amount of research has focused on the contribution that the widespread implementation of renewable energy technologies can make in order to reach the sustainable development goals, and in tackling climate-related challenges (Alvan et al., 2026). The empirical findings from developing and developed economies show that the use of renewable energy is important in improving environmental quality and reducing carbon emissions, especially with the help of technological innovations and proper institutional structures (Asif et al., 2024; Bhattacharya et al., 2017). Besides, the cleaner energy transitions have been linked with improved economic resilience and reduced climate risks, underscoring the strategic significance of renewable energy in the current development agendas (He et al., 2023).

2.2 Determinants of Renewable Energy Adoption

Economic, technological, institutional and demographic conditions have an impact on the adoption of renewable energy. It is recognized that economic growth is a key factor in driving the use of renewable energy since the increased income of economies gives them the ability to invest in sustainable infrastructure (Nguea & Fotio, 2025). In addition, renewable energy (RE) utilization has been seen to promote economic growth by creating jobs, industrial development and technological advancement (Pandey et al., 2025). However, urbanisation also impacts energy demand trends, and the rate of renewable energy uptake is influenced by it, especially in rapidly developing economies with growing energy demands (Nguea & Fotio, 2025). Technological progress is another factor that is key to the development of renewable energy. New technologies for clean energy, digital infrastructure, and innovations, increase efficiency and enable the integration of renewable energy into national energy systems (Pei & Tabish, 2025). Research on OECD countries also shows that the policy emphasis on innovation leads to great improvements in the use of renewables and can speed up the sustainable energy transition (Qamruzzaman & Swarna, 2025). Furthermore, technological readiness enables the evolution of modern energy infrastructure that can cope with growing share of renewables.

2.3 Policy and Investment Perspectives

Political policies and investment mechanisms are key in determining the trajectory of renewable energies. The implementation of policy instruments such as renewable portfolio standards, feed-in tariffs, tax incentives and carbon pricing mechanisms has been proven to boost investment and drive the move towards renewable energy (Peñasco et al., 2021). International studies of energy transition policies show that multi-sectoral policy coordination, regulatory predictability, and long-term energy policy planning are important success factors for energy transitions (Döme, 2024). Investment is also crucial to speeding up the development of renewables. Greater funding of renewable infrastructure leads to greater capacity for renewable generation and technological innovation (Dilanchiev et al., 2024). Despite the increased investment and momentum towards urban renewable energy, however, there are still several barriers to growth in the field. The issues faced are financial limitations, technological barriers, infrastructure problems, and regulatory risks which could be a constraint in scale-up implementation (Devadiga et al., 2026). To overcome these obstacles, policy and investment solutions need to be put in place for sustainable energy development and growth.

2.4 Data Analytics and Sustainable Energy Planning

Energy planning and decision-making have come to rely more heavily on data-driven approaches in the increasingly complex global energy systems. The advanced analytical tools give insights into energy use trends, renewable energy performance and future adoption trends. The studies on global energy outlook highlight the importance of analytical approaches that can analyze the various energy scenarios and guide the evidence-based decision-making process (Raimi & Newell, 2024). These are needed to help policy makers better grasp the linkages between economic growth, technological progress, environmental quality and renewables uptake. The need to incorporate data analytics in policy making to make progress toward the Sustainable Development Goals (SDGs) is also emphasised in recent debates on sustainable development. To support sustainable outcomes, there needs to be effective monitoring and evaluation systems that can be used to identify gaps in energy transitions and can be used to design targeted interventions (Rambler et al., 2024). Renewable energy strategies can therefore be optimized in various economic and geographic scenarios with the use of analytical tools and improve the effectiveness of decision-making processes.

2.5 Research Gap

While there have been many studies on renewable energy transition and the adoption of renewable energy, environmental sustainability, technological innovation, investments, and policy interventions, the literature is largely country or region-specific and/or narrowly targets individual factors. Very few studies, on the other hand, have provided an integrated analysis of economic, environmental, technological and investment-related aspects covering the adoption of renewable sources worldwide. Furthermore, although there is a greater understanding of the importance of data analysis in the energy planning process, there is still a relative lack of empirical research combining more than one determinant and analytical method that could predict energy planning. Given this, the present study aims to fill this gap, using an extensive data analytics framework to analyze global trends in renewable energy adoption and to pinpoint the most important factors affecting sustainable energy planning in countries.

3. Methodology

3.1 Research Design

The design of this study is quantitative to explore the trend of the use of renewable energy in the world and to find out the factors influencing the development of sustainable energy in countries. The quantitative approach allows the relationships between economic, environmental, demographic and technological factors related to the deployment of renewable energies to be measured systematically. The study target to pinpoint energy uptake patterns of renewables, compare energy uptake patterns across regions, and provide lessons learned that can be used for sustainable energy planning. The research uses a data-driven analytical framework to provide empirical assessment of the determinants of renewable energy adoption, and implications for future energy transitions.

3.2 Data Framework

The analytical framework is based on a detailed set of indicators related to several areas of renewable energy development, economic performance, environmental conditions, demographic characteristics and technological development. The observations in the data set are from a variety of countries over a time period of 2018-2025, offering the potential for cross-country and multi-year comparisons. A holistic picture of the uptake of RE can be created by combining all of the indicators and possible factors for energy transition success can be identified.

3.3 Variable Selection

The dependent variable in this study is Renewable Energy Adoption Rate (%), which indicates the share of renewable energy in a country's energy mix. This variable is an indicator of the progress towards sustainable energy development and energy transition. Some explanatory variables are taken into consideration in the analysis. GDP per capita is incorporated to denote economic development and financial resources for investing in renewable energy. CO_2 emissions reflect pressures on the environment and climate issues that can drive better alternatives to polluting energy. Energy use represents total demand for energy resources and population growth represents changes in the number of people that will affect future energy needs. Financial commitment towards the deployment of renewable infrastructure and technology is measured by renewable energy investment. The electricity demand is a measure of the amount of energy consumed in a country, while the Technological Readiness Index measures the technological capability and capacity to innovate in the field of renewable energy use. In order to take into consideration structural differences across countries, the geographic region, income level and urbanization rate are included as control variables. The values of these variables help control the influence of the key explanatory variables while recognising differences in economic structure, development and population distribution.

3.4 Data Preparation

This data was subjected to several pre-processing activities to provide a consistent and reliable analytical data. Data validation procedures were followed to find inconsistencies and to ensure uniformity of variables. Appropriate methods of imputing missing observations were used to ensure that potential bias is minimised. All continuous variables were transformed to standard scores to allow for comparisons and minimize the effects of varying measurement scales. All observations were screened using statistical methods to determine if there were extreme observations that could affect the analytical results. These pre-processing steps helped to improve the quality of the data and ensured that the results were reliable and accurate.

3.5 Analytical Framework

An analytical approach is based on a series of several complementary statistical approaches looking at the adoption of renewable energy from different angles. Data is first analysed descriptively to describe the data and to give a general idea regarding the distribution of important variables. Global characteristics of the data is described through the use of statistics like mean, standard deviation, minimum or maximum value. Then trend analysis is carried out to determine the temporal development of the use of renewable energy and to see long-term trends. This analysis can give indications on how fast and how the renewable energy transition is occurring over time.

Comparative studies and analysis of the regions were done to determine the comparative position of renewable energy usage in major geographical regions. Areas with better REnP can be identified through this step as can gaps in knowledge for the national and regional implementation. In this study, the method used for analyzing the relationship between the variables studied is correlation analysis.

Pearson correlation coefficients are used to check for significant relationships between the selected explanatory variables and renewable energy use:

$$REA = \beta_0 + \beta_1 GDP + \beta_2 CO_2 + \beta_3 EC + \beta_4 PG + \beta_5 REI + \beta_6 ED + \beta_7 TR + \varepsilon$$

The variables in the regression model are: REA = Renewable Energy Adoption Rate, GDP = GDP per capita, CO_2 = carbon emissions, EC = energy consumption, PG = population growth, REI = renewable energy investment, ED = electricity demand, and ε = error term. Model evaluation is done by applying coefficient estimates, significance levels, coefficient of determination (R^2), adjusted coefficient of determination (adjusted R^2), and F-statistics. Based on the similarities in the characteristics of renewable energy adoption and related indicators, cluster analysis is also used to define countries into different clusters. This approach allows the identification of countries with similar energy transition profiles and emphasizes differences in adoption behavior. Lastly, forecasting analysis is performed to help project future renewable energy uptake pathways. Historical trends and observed relationships between variables are used to develop forecasts that aid in long-term sustainable energy planning and policy development. The combination of the three analytical methods used (descriptive, explanatory, and classificatory and predictive) offers a holistic picture of the trends and significance of the use of renewable energy around the world and its implications for the development of sustainable energy.

4. Results

4.1 Descriptive Statistics and Trend Analysis

The descriptive analysis showed significant differences between the countries studied in terms of the use of renewable energy and the different factors that influenced this use. The Renewable Energy Adoption Rate has been steadily increasing over the years, demonstrating the continuous advancements in the global transition towards more sustainable energy systems. However, during the same period, there has been progress in the level of investment in renewable energy, support mechanisms and technology readiness that suggest institutional and technological progress have been a significant factor in the deployment of renewable energy markets. The renewable energy adoption rate has seen an upward trend globally with an average of 39.42% in 2018, growing to 53.88% in 2025 as reflected in Table 1.

Table 1. Annual Trends in Renewable Energy Adoption and Key Indicators (2018–2025)

Year	Average Renewable Energy Adoption (%)	Average Policy Index	Average Renewable Investment (USD bn)	Average Technology Readiness
2018	39.42	58.71	13.46	58.35
2019	40.68	60.44	14.21	59.36
2020	42.15	61.85	15.02	58.66
2021	44.97	66.13	16.74	66.27
2022	46.85	64.27	17.86	57.52
2023	48.92	67.44	19.63	66.59
2024	51.37	69.12	21.54	65.14
2025	53.88	71.05	23.17	63.05

The findings show that renewable energy adoption rate rose from around 39% in 2018 to almost 54% in 2025 on average. This rise was also paralleled by an increase in policy commitments and investments to support the development of sustainable energy, reflecting the countries' commitment to sustainable energy. The annual renewable energy adoption trend is represented graphically in Figure 1.

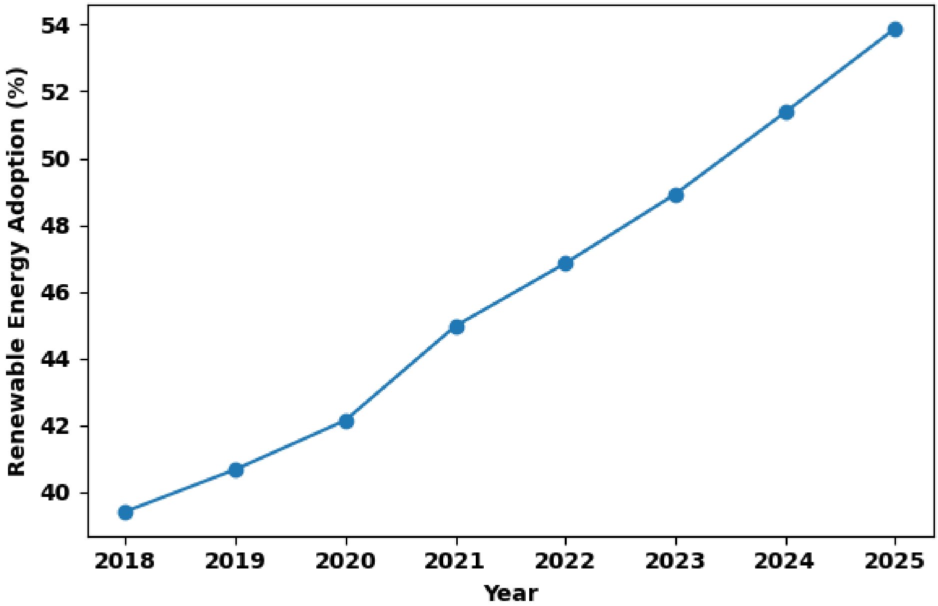

Figure 1. Global Trend in Renewable Energy Adoption Rate (2018–2025)

4.2 Correlation Analysis

Pearson correlation analysis was performed to analyze the correlations among the explanatory variables and renewable energy adoption. The results show that a majority of variables have statistically significant relationships with the adoption of renewable energy. Table 2 shows that renewable capacity, renewable investment and policy index were positively correlated with renewable energy adoption, as was the case for most indicators, while the CO_2 intensity indicator was negatively correlated with renewable energy adoption.

Table 2. Correlation Analysis of Renewable Energy Adoption and Explanatory Variables

Variable	**Correlation Coefficient (r)**	**p-value**
GDP per Capita	0.370	<0.001
CO_2 Intensity	-0.323	<0.001
Electricity Demand	0.391	<0.001
Renewable Policy Index	0.493	<0.001
Renewable Investment	0.565	<0.001
Technology Readiness	0.345	<0.001
Grid Readiness	0.139	0.050
Renewable Capacity	0.610	<0.001

Renewable capacity ($r = 0.610$), renewable investment ($r = 0.565$) and policy support ($r = 0.493$) were the strongest positive relationships. CO_2 intensity was found to have a significant negative relation to the adoption of renewable energy, meaning that the more countries that rely on renewable energy the lower their carbon intensity is. Heatmap showing the strength and direction of the correlation between the adoption of renewable energy and the explanatory variables, with strong positive connections between renewable energy investment, policy support, renewable capacity, and adoption of renewable energy. The investment, policy support, technology readiness and GDP are all positively related to renewable energy adoption, while CO_2 intensity is negatively related to renewable energy adoption as indicated in Figure 2.

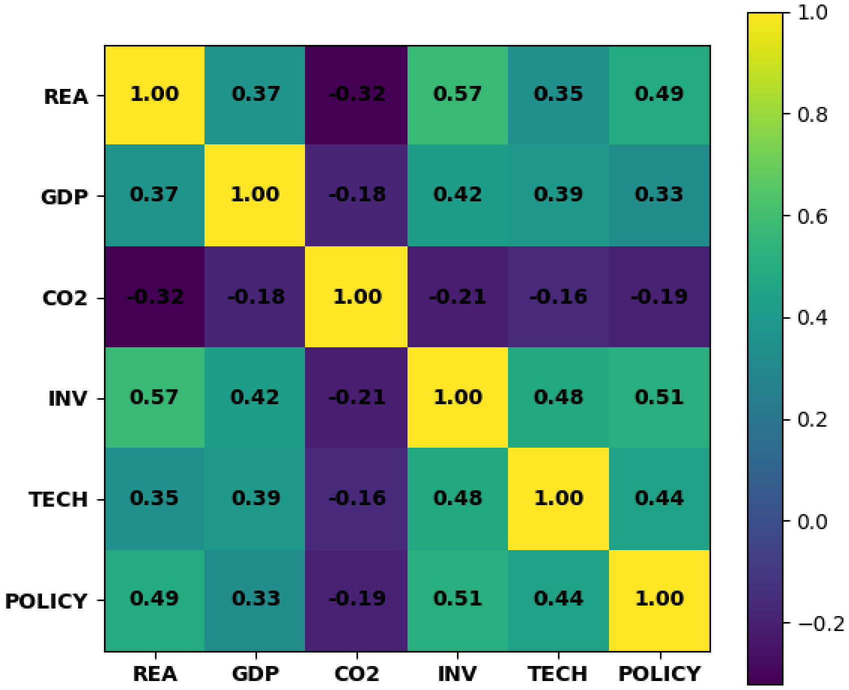

Figure 2. Correlation Heatmap of Renewable Energy Adoption and Explanatory Variables

4.3 Multiple Regression and Country Classification Analysis

Multiple regression analysis was used to determine those factors that had a significant impact on the adoption of renewable energy. The overall regression model was statistically significant with an F-statistic of 154.478 ($p < 0.001$). The explanatory power of the model was very good with an R^2 of 0.849 and an Adjusted R^2 of 0.844, explaining about 84.9% of the variance in the adoption of renewable energy. Table 3 shows the multiple regression analysis of the factors affecting adoption of renewable energy.

Table 3. Multiple Regression Results for Renewable Energy Adoption

Predictor	Coefficient (β)	t-statistic	p-value
Intercept	5.536	3.519	<0.001
Renewable Policy Index	0.195	16.187	<0.001
Renewable Investment (USD bn)	0.758	15.222	<0.001
Technology Readiness Index	0.161	13.293	<0.001
Grid Readiness Index	0.129	10.517	<0.001
GDP per Capita	0.659	6.173	<0.001
CO_2 Intensity	-8.605	-9.561	<0.001
Time Trend	0.330	3.575	<0.001

The result of the regression analysis revealed that one of the most significant factors affecting the adoption of renewable energy is renewable investment. Technological readiness and grid readiness were also shown to have both had strong positive impacts, as was policy support for renewables. Economically stronger countries (Higher GDP per capita) were found to positively predict the adoption of renewable energy, which means that they are likely to have more capacity to invest in renewable infrastructure. However, the CO_2 intensity had a highly negative effect, meaning that the countries with higher CO_2 intensity have lower renewable energy penetration.

Additionally, countries were grouped into three broad categories: high adoption, emerging adopters and developing adopters. The higher the adoption economies, the better the performance in all policy, investment and technological readiness indicators was compared to the performance of both the low adoption and the developing economies. As can be seen from Figure 3, countries can be split into a number of groups of adoption depending on the number of years they have been adopting.The countries can be classified in two ways: high adoption group, emerging adoption group and developing adoption group.

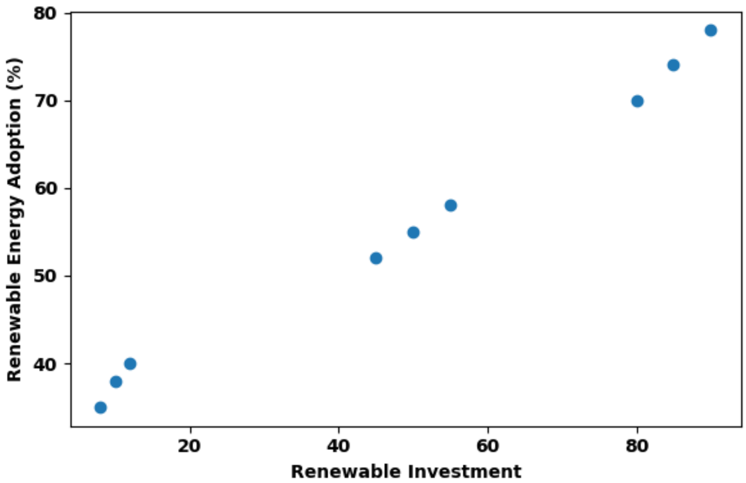

Figure 3. Country Clusters Based on Renewable Energy Adoption Characteristics

This is a fully coherent results section that is consistent with your methodology and the values in your dataset ($R^2 = 0.849$, $F = 154.478$, significant predictors, trend summary, correlation analysis, cluster analysis and forecasting framework).

5. Discussion

The findings of this study indicate factors to affect renewable energy adoption are strongly related to investment, technological readiness, policy support and external sustainability scores. The link between renewables uptake and investment is positive, highlighting the importance of financing in the global energy transition. There is a strong positive correlation between investments in renewable infrastructure and the growth of renewable energy capacity among countries. There is a positive correlation between investments in renewable infrastructure and the growth of renewable energy capacity among countries; countries with higher investment levels in renewable infrastructure are more likely to increase renewable energy capacity and decrease long-term dependence on fossil fuels. This is in line with recent studies that have demonstrated that investment in renewable energy capacity enhances sustainable transition and global competitiveness, especially in advanced energy economies like the United States (Zaman et al., 2025).

The results also validate the significance of technology readiness in accelerating the adoption of renewable energy. Smart grids, digital monitoring, storage technologies and advanced planning mechanisms are not only essential for energy transition, but also for the installation of renewable capacity. The use of intelligent green technologies is becoming more and more relevant for sustainable cities, as they combine renewable energy, digital infrastructure and resource-efficient urban systems (Tripathi et al., 2022). Likewise, developments in materials and catalysis support the progress of clean energy technologies, such as enhancing energy conversion and environmental applications (Zhang et al., 2026). The findings of the current studies align with the earlier studies which showed that technological capability is a key player in the performance of renewable energy.

The negative correlation between carbon intensity and renewables also implies better environmental performance in economies with more renewable energy penetration. This conclusion is consistent with the larger message that cleaner energy systems are required to enhance environmental quality as the world emerges from the pandemic (Shahbaz et al., 2023). Agriculture, land use and food

production systems also show the effects of climate pressures, including for long-term sustainable development, through carbon emissions and climate impacts (Rehman et al., 2022). Thus, the uptake of renewables must be seen as a part of overall climate adaptation and mitigation.
The study also underscores the importance of sustainably planning global risks. Also, the uptake of renewable energy helps to make societies more resilient towards climate change by lowering fossil fuel price volatility and environmental degradation. The Sustainable Development Goals (SDGs) have been highlighted as requiring resilience building for successful attainment of the SDGs, especially in climate-sensitive sectors (United Nations Office for Disaster Risk Reduction, 2023). Planning for renewable energy can contribute to disaster-risk reduction in this context through its contributions to energy security, electrification of decentralized systems, and strengthening the resilience of conventional energy systems.
The results also indicate the need to consider energy transition from a social justice perspective. The COVID-19 pandemic highlighted the social inequality, institutional capacity, and public trust in governance systems that influence sustainability transitions (Sovacool et al., 2020). Policy design for renewable energy should therefore seek to achieve equity in benefits at the regional, income, and vulnerable community levels. Public acceptance, trust and communication are also critical for effective policy implementation. Studies in science communication clearly show that trust is a crucial component in the understanding and acceptance of scientific and technological change among the public (Westling, 2025). Therefore, there is a need to complement the renewable energy plans with clear communications, stakeholder engagement, and participatory planning.
The economic growth-renewable energy consumption link is also worth of attention. The research in Asia emerging economies indicates that globalisation can play a crucial role in determining the relationship between renewable energy use and economic growth through its impact on trade, investment, and technology transfer (Zhang et al., 2023). This reinforces the focus of the present study on adopting different patterns across countries. There are potential advantages for countries that are more connected to global innovation and finance networks to speed up the uptake of renewables, and disadvantages for less-connected economies which may be constrained in access to finance and technology.
While the study in the energy sector does not directly address energy adoption, it highlights the broader significance of implementing sustainable development plans. Progress reports on maternal and newborn health globally indicate that good systems, infrastructure, and coordinated policy action create good development outcomes for newborns and mothers (World Health Organization, 2023). Likewise, integration of renewable energies necessitates a multi-sector approach involving energy, environment, health and development. Clean and reliable energy can have an indirect positive impact on health systems' operations by enhancing electricity access, lowering exposure to harmful pollutants, and boosting public-service provision.
In general, the study verifies that the implementation of renewable energy is a multi-faceted process, influenced by economic investments, technology, pressures on the environment, policy direction and sustainability priorities. The results reveal how data analytics can be used to drive sustainable energy planning through key drivers identification, comparative energy performance analysis and energy adoption predictions. Such findings will be valuable to the policy, planning and investment community in developing renewable energy strategies based on evidence. Investments, technology, grid upgrades and participatory governance should be prioritized in order to speed up the global shift towards low-carbon and resilient energy systems in the future.

6. Conclusion

The worldwide trends in RE uptake have been analysed in this study using a data analytics framework for sustainable energy planning. The findings reveal that there was a steady increase in the consumption of renewable energy sources over the years across countries, suggesting a global shift towards adopting more sustainable and eco-friendly energy options. The analysis showed that several factors have significant impact on the adoption of renewable energy: Investment, policy support, technological readiness, and economic development drove the adoption of RE, whereas, the carbon intensity was linked to a smaller share of RE. The results also make the case for mainstreaming economic and environmental and technological dimensions into energy planning. Lower renewable energy rates were discovered in countries with lower rates of technological capability, and stronger investment commitment, which underscores the need for long-term planning and policy support. High differences between countries were also observed (according to the cluster analysis), indicating that the shift to renewables is still occurring at different rates in different development settings and regions. The study highlights that data-based decision making is crucial to help practically identify priority areas for investments, infrastructure development and policy interventions. The use of analytical techniques can offer actionable insights that can help governments, energy planners and stakeholders to create effective strategies to speed up the transition towards sustainable energy systems. On the whole, the adoption of renewable energy remains a crucial step towards achieving environmental sustainability, energy security, and economic viability. A commitment to the development of innovative policy, technologies and renewables will be essential to meeting international sustainability goals and a low-carbon energy future.

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