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THE ROLE OF GREEN ECONOMY IN MITIGATING CLIMATE CHANGE IN PAKISTAN: A STUDY UNDER SUSTAINABLE DEVELOPMENT GOALS

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ABSTRACT

In light of the Sustainable Development Goals (SDGs), specifically SDG-13 (climate action), this study examined at how a green economy might be helps in Pakistan mitigate climate change. Pakistan is one of most climate-vulnerable nations of world. Rising temperatures, and melting glaciers, and erratic rainfall patterns, and the frequent extreme weathers events pose serious environmental problems to the whole nation, endangering all lives, agricultural, water supplies, and all public health. This study investigates how the green economic practices as such as the use of renewable energy, sustainable agriculture, resources efficiency & environmental conservation can promote climate resilience in Pakistan. The study's foundation is of Ecological Modernization Theory that, which highlighted how technology and the advancement, institutional changes, and sustainable policy of the frameworks may also allow of environmental preservation and economic growth to coexist. The study comes to find conclusion that are successful shift to the sustainable development requires as a concerted afforded by public, and commercial, and civil society sectors. Pakistan can be reducing climate risks, and promoted equitable economic growth, by the bolstering green policies and investments. Pakistan is at a pivotal point in its growth, and while the globe struggles with the environmental degradation as well as climate changes.

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INTRODUCTION

In the 1989, UK government paper name as blueprint for a green economy, which aimed to describe sustainable development and its financial implication say that "green economy" was first used. This idea was then expanded on two further reports: drawing from significant environmental economics research & blueprint 2: Greening the World Economy (1991) & Blueprint 3: Measuring Sustainable

Development (1994) expanded focus to global economic challenges such are resources depletion and climate change. Following the global financial crisis in, 2008, the United Nations Environment Programmed (UNEP) promoted green stimulus packages and encouraging countries to incorporates sustainability into their plans for economic recovery. This led to the term's rise to prominence. And then UNEP launched the Green Economy Initiative. One of the original writers of the Blueprint created the "Global Green New Deal" report in 2009, that includes measures intended to promotes sustainability and accelerate economic recovery. When the UNEP Global Ministerial Environment Forum recognizes the green economy's potential to address the global issue in 2010, interests in it increased globally.

The green economy was also adopted by the UN General Assembly that year as a major issue for the 2012 Rio+20 Conference, which sparked as heated debate and rekindled interest in research. This culminate in 2011 UNEP Green Economy Report, which provided a definition of green economy and was endorse by a number of commercial companies and research tanks. Many UN organizations and non-governmental organizations has started to advance green economy by creating, many policies and assessing its advantages and disadvantages. As a response to, global problems include resource scarcity, environmental degradation, and climate change, green economy has grown, in significance (Aijaz, Butt & Ghauri, 2021). It places an emphasis on lower carbon emissions, improving resources and energy efficiency, and safeguarding ecosystems and biodiversity. A key tactic for sustainable development that balanced economic expansion with environmental conservation is shift of normal to a green economy (Humayun, Li, Niazi, Humayun & Younas, 2025). This is the approach aimed to reduce environmental dangers & ecological scarcity while creating economic growth & employment possibilities without diminishing the natural resources that compulsory for the survival (Newton & Cantarello, 2014).

The climate change presents the serious social, environmental and economic issues for the Pakistan. Due to severe poverty, high population density, a significant reliance on the natural resources, and a limited ability to adapt to the effects of climate changes, the nation is especially susceptible (Jan, Durrani & Khan, 2021.). As a result, Pakistan is the creating an action plan to include climate issues into its planning and has created national policies to the combat climate changes (Khan & Majeed, 2022). Thus, rising of the temperatures, the erratic rainfalls, glaciers melting, and frequent extreme weather events are some of the negative consequences of the climate changes that Pakistan faced as one of the most climate-vulnerable countries, the food security, the water resources, health, and livelihoods are all under risk from these occurrences, and particularly in the vital the agricultural sector that employs a sizable section of the populace (Zukhri, Rosalina & Christianingrum, 2022). In this drive, research is to the investigates, the role of the international communities in minimizing the consequences of climate changes, addressing the environmental concerns, encourage resource conservation, as well as look at, institutional opportunities and obstacles for tackling the climate change in Pakistan.

Despite some advancements, with over 39% of its people living in the poverty and another 12.9% categorized as a vulnerable, Pakistan suffers as from multidimensional poverty, which raises the country's risk of the environmental degradation, biodiversity loss, and the climate change. Pakistan

is one of the nation's most vulnerable to climate change, although the contributing less than 1% of the world's greenhouse the gas emissions in order to guarantee sustainable growth, Pakistan needs to improve the living circumstances for its most disadvantaged citizens (Fatima, Arif & Arif, 2026). While shifting to an economic model that lower the greenhouse gas emissions and makes better use of resources like energy and the water, Pakistan must improve inclusive economic opportunities and the basic services for young people (Kousar, Bhutta, Ullah & Shabbir, 2023). In this context, the concept of a green economy has emerged as a strategic approach for promoting environmental sustainability while supporting economic growth and social development (Aijaz, Butt & Ghauri, 2021). In order to protect societal values and deals with problems like environmental degradation and climate changes, which endangers both ecosystems and the economy, it is imperative to shift toward green growth.

LITERATURE REVIEW

The notion of a green economy has been gained supports among policymakers over the last decades the, yet its definitions and links to the sustainability are still unclear. This study recognized and investigated variety of green economy ideas and techniques, such as environmental and ecological economics, cleaner production, waste hierarchy, bio-economy, industrial ecology, circular economy, and natural solutions, and life cycle assessments. It presented a framework for better understanding how these notions might help with the transition to the sustainability; evaluating's their capacity to balances environmental and economic advantages. The debate focused upon the various effects of these techniques on strong and weak sustainability, highlighting structural changes has required in our lives to effectively operationalize the green economy (Loiseau, Saikku, Antikainen, Droste, Hansjürgens, Pitkänen, & Thomsen 2016). Policymakers frequently the viewed green the growth and sustainable development as mutually beneficial. However, green growth alone cannot provide long-term economic development owing to continued global environmental and deterioration and ecologically scarcity.

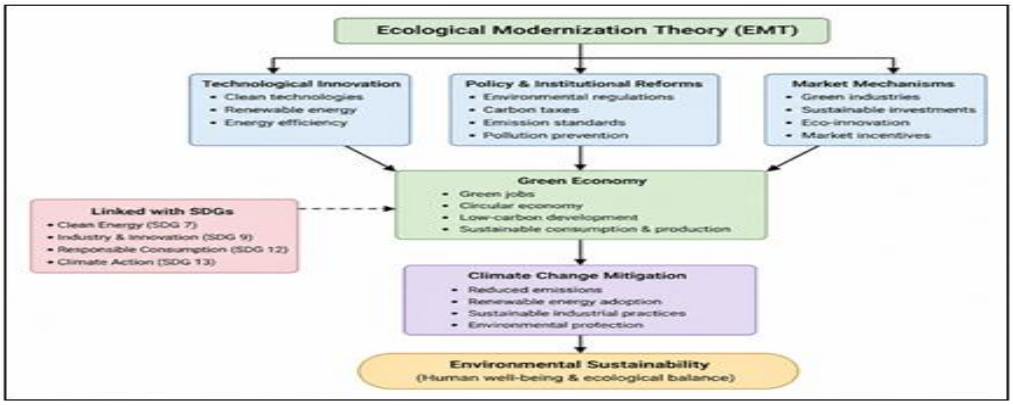
Addressed these concerns and necessitated confronting sustainability and financial challenges. The sustainability the problem entailed overcoming market, governmental, and the institutional flaws that hid the economic importance of environmental scarcity. The financial problem referred to the disparity between the global ecological benefits and willingness to paid for their preservation. Key steps toward the addressed these difficulties included the improving economic understanding of ecological scarcity, identified the loss of benefits and successfully translated this into policy, and studied creative finance strategies to promote ecosystem conservation (Barbier, 2011). Globalization has had the significant influenced on economy, ecology, and society during the past decades, with green economy emerging as the critical policy framework for growth in developed and developing countries (Newton & Cantarello, 2014). Globalization, the green economy, and climate change, and emphasized numerous definitions and conflicts, among green economic discourses. It highlighted both the environmental the consequences of the natural resource depletion and the advantages of environmental management.

It also looked at how climate change affected the green economy and infrastructure development, &, the role of economic institutions in resolving environmental challenges and increasing production

of efficiency. The study indicated that pursuing a green economy can reduced poverty and enhance access to healthy environment, hence improved human security & reducing disputes, over natural resources (Zhang, Xu, Chen, Li, & Chen, 2022). Both the environment, and climate modeling are the greatly impacted by economic activity. Initiatives and strategies for green economy, and green growth is developed as a result of, and in recent years, public policy measured have supported these efforts (Khan, Yu & Umar, 2022). The article emphasized the difficulties in environmental and economic development, as well as contribution of growth and the green economy to sustainable development. Green growth encouraged economic expansion while preserving natural resources, marked it a useful tool for sustainable development. Examined is relationship between, sustainable development, and green growth, and green economy, highlighting mutual support and coexistence (Dogaru, 2021).

An increased in green growth boosted environmental the quality. Green innovations are conducive to carbon reduction. ICT impeded environmental sustainability. The moderating role of ICT with green innovation fosters environmental quality. Moderating role of ICT with green growth hindered environmental sustainability (Lin & Ullah, 2023). As time goes on, climate change becomes a more urgent problem, and green growth and innovation play a key rolled in promoting cleaner economic growth and a healthier environment by lowering environmental pollution. Numerous studies have showed that wide range of factors influenced environmental contamination (Kousar, Bhutta, Ullah & Shabbir, 2023). Pakistan has significant renewable energy potential due to its geographical and climatic conditions. Increasing investment in renewable energy reduces dependence on fossil fuels, lowers greenhouse gas emissions, supports clean and sustainable energy production. These studies have not sufficiently looked at how green growth, green innovation, and ICT affect CO2 emissions. The significance of green growth (GG) and green innovation (GIN) for sustainable development is emphasized in study.

Figure1 Theoretical Framework of Ecological Modernization Theory



By examined how green growth affected CO2 emissions in Pakistan, particularly in light of green technologies and ICT, our study seemed to close this gap. This study's integration of ICT interaction with green growth and green innovation is a major innovation. According to findings of augmented ARDL research, green innovation & growth greatly boosted Pakistan environmental sustainability

(). ICT, on the other hand, has a strong positive correlation with CO2 emissions. CO2 emissions are also increased by the interaction between GG, ICT, although the function of the interaction term GIN ICT improved the quality of the environment. The environmentally friendly farming methods, water-efficient irrigation systems, organic farming, and climate-smart agriculture help reduce environmental degradation while maintaining food security and rural livelihoods. These initiatives help reduce carbon emissions and create healthier urban environments. Consequently, in order to reduce the CO2 emissions and accomplish sustainable development objectives, policymakers and regulators should concentrate on advancing a green growth agenda and green innovation (Lin, & Ullah, 2023).

Using data from 2000 to 2018, this study examines how traditional versus green economic growth affects poverty, income inequality, and environmental degradation in South Asia, particularly in Pakistan, India, Sri Lanka, Nepal, and Bangladesh. The study determines stationarity of variables and their relationships by using sophisticated econometric methods like co-integration analysis and second-generation unit root tests. It shows that poverty and inequality are adversely affected by both traditional GDP and green GDP, with green GDP having a greater effect also encourage environmentally responsible practices within communities and industries. This linkage is especially important in developing countries like Pakistan, where economic development and environmental sustainability must be achieved simultaneously. Besides, green GDP is linked to a notable decrease in environmental degradation, even though economic growth as well as degradation are positively correlated. In order to improve environmental sustainability and reduce poverty and inequality in the area, study suggests that policymakers support green economic growth (Kousar, Bhutta, Ullah, & Shabbir, 2023).

Making the shift to a green transformation is essential, given the current state of the world economy. One important measured of a country's or region's ability to achieved sustainable development goals is green total factor productivity (TFP). Thus, the factors influenced green TFP in the China's manufacturing and logistics sectors are examined in this panel study. Using data from the twelve Chinese cities taken from the National Economic and Social Development Statistics Bulletin and the China Urban Statistical Yearbook (2005–2019), and it specifically examines the interaction of technological input, environmental policies, governmental involvement and collaboration between the manufacturing and logistics the industries, and renewable the energy consumption offers the comprehensive pathway for balancing the economic growth, environmental protection, and social well-being. International cooperation, climate financing, and support from the global organizations also play a crucial role in helping Pakistan implement green economy initiatives and climate adaptation strategies. The study found the strong relationships between aforementioned (Khan, Yu, & Umar, 2022).

Theoretical Framework

This study is grounded in Ecological Modernization Theory, which gave the concept that economic development can be occur through green technologies and sustainable policies that also lead to environmental improvement. In the context of Pakistan, the green economy plays a very effective and significant role in mitigating climate issues by reducing emissions and promoting sustainable

practices. In the 1980s in Western Europe, particularly in Germany and Netherlands, Ecological modernization theory (EMT) emerged with key contributors including Joseph Huber, Arthur P. J. Mol, and Gert Spaargaren. It developed as a response to the earlier environmental theories that are viewed economic growth and the industrialization as a harmful to the environment. In contrast, EMT argues that the modernization and the development can actually be helpful to solve environmental problems. In this connection, it emphasized the use of clean technologies, and strong government's regulations such as carbon taxes along with the emission standards, and the impact of markets in promoting green industries. This theory also focuses on preventing pollution rather than controlling it after it occurs.

Furthermore, Ecological modernization theory is closely linked and connected to Sustainable Development Goals (SDGs) of the United Nations, especially the goals that are closely related to clean energy, sustainable industry, and responsible consumption, and climate action. It emphasized and support on climate change reduction by promoting the renewable energy, improving energy efficiency, encouraging sustainable industrial practices, and enforcing environmental regulations. The concept of a green economy is central to EMT, as it aims to improve human well-being while reducing the environmental risks through green jobs, sustainable investments, circular economy practices, and low-carbon development. Overall, EMT, SDGs, and the green economy work together to reduce climate change by combining innovation, policy reform, and sustainable development strategies. Still, this theory is sometimes criticized for being overly optimistic about the technology and for not totally addressing global inequalities issues. Despite this, ecological modernization theory remains and crucial, important and one of practical approach for achieving environmental sustainability.

Figure2 Ecological vs Traditional Environmentalism

RESEARCH METHODOLOGY

The study examined how Pakistan's green economy helps achieve the Sustainable Development Goals and lessen climate-related problems using a qualitative document analysis technique. Using qualitative text analysis to identify and develop topics related to sustainable development, green technology, and economic growth that also enhance the environment. Analytical approaches have been used throughout the study process to move forward and reach a conclusion. Journals, news,

official websites, books, reports, policy papers, case studies, and research articles selected from the reputable national and international sources are amid main resources that have been investigated in order to gain a more inclusive understanding. Reliability was ensured via transparent procedures and reliable sources.

RESULT & DISCUSSION

Pakistan's Transition to a Green Economy: Challenges & Opportunities

A green economy is newly emerging concept improved human well-being, economic development and social equity while significantly reducing to eliminate and environmental risks and ecological scarcities. For Pakistan, this transition emphasizes on sustainable agricultural practices & renewable energy sources, resource-efficient productions and consumptions. moving toward a green economy, and marked by reduction in carbon emissions, efficient resource utilization and social equity, which are a topic of critical importance, especially are for low and middle-income nations like Pakistan. The study revolves around in dual objectives like that, achieving its sustainable economic growths with now while safeguarding the planets for future generations. Pakistan ranks 15th in the Climate Change Performance Index. The country receives a very high rating in Green House Gas Emissions & Energy Use, low in Climate Policy, very low in Renewable Energy. As to 2023 UN report, say that Pakistan is ranked as 5th most vulnerable to climate issue country to climate change, with climate disasters that are of caused significant damages, affecting millions of people of affected area, and displacing them millions from homes, resulting in approximately 3.3 trillion in losses (Berrang Ford, Ford, & Paterson,2011).

However, as beyond to the climate prospect economy is beneficial not only climate but economy. Pakistan has potential to embrace green practices is essential. The government of Pakistan must be provided, targeted the public spending, and implemented policy reforms, and makes the required adjustments in all taxation and regulations to support them green initiatives. EMT main idea is that the economic development and the environmental protection can be go hand in hand through the technological innovations, institutional reforms, sustainable policies. Still, this economic transition is required cooperative and mutual efforts from various stakeholders (Asghar, Cheema, & Muzaffar, 2025). The private sector, of Pakistan that are in charge of increasing of resource efficiency during production of by using renewable energy sources and reducing consumptions of natural resources, and is another key participant. The other is, the community's desire to invest in environmentally for friendly goods, services are crucial, in making it as third important stakeholder. Thus, these choices fortified it eco-friendly & lifestyles with little natural resource usage, even if they are may initially be more expensive.

This aligned with the principles of sustainable development and consumption and production, which aimed at improving production methods, and consumption habits to reduce resource usage, waste generation, and emissions throughout the entire life cycle of processes and the products. It is crucial to as analyzed the state's capability and capacity and institutional structures in order to determine that Pakistan's preparedness, for a green economy. The national electric car policy, and which are inspires the used of electric vehicles by lowering the and decrease in import taxes and

customs charges and providing toll refunds, and is one of climate policies implemented by Pakistan Ministry of Climate Change and Environmental Coordination. The transportation sector, which are accounts for 43% of airborne emissions, are also the focused of this program. However, there are of obstacles to the transitions in economic sustainability since of electric cars are still more costly than conventional ones, and there isn't enough, infrastructure to support them (Sheikh, Manzoor, Adnan, Ashraf, & Khan, 2009).

Figure 3 Green Economy

Pakistan is now dealing with a number of problems that restrict its capacity to engage in green projects, such as trade, fiscal, and current account deficits as well as circular debt and debt payment requirements. The crude oil industry receives more than 90% of subsidies, which lowers the cost of gasoline and power for consumers while impeding the transition to the renewable energy sources. However, with plenty of sunshine and ideal weather, Pakistan is one of the nations with a great deal of potential for solar and wind power generation (Fatima, Arif, & Arif, 2026). By using wind turbines, the coastal belt regions alone have capacity to produce 50,000 MW of power. 1,335 MW of private wind power are now in service, and more are being built. Six solar power plants, totaling 430 MW have also started up in the previous five years that are providing electricity to the grid, with goals of serving minimum of one million consumers. They want to use of net metering to add about 3,000 MW of solar electricity.

Reducing powers costs and easing to the strain on Pakistan's trade balance owing to a drop in crude oil imports, roughly $30 billion USD that are two benefits of shifting the energy industry to green one. Still, these changes are hampered by agreements with both independent power producers, (IPPs) and budgetary limitations imposed by the government (Arif, Arif, & Fatima, 2026). Finally, the community's attitudes towards environmentally friendly products, and services are important. High inflations and growing electricity costs, have lifted the population facing serious financial issues, with an estimated 37.2% poverty rate and a 38% reduction in buying the power, due to the excessive food prices in 2023. Affordability with difficulties is already limiting their capacities to the acquired expensive things, and limited the purchasing power that influences their consumption

patterns, as well as the also preferences for the green activities and products (Farooq, Asghar, & Rasheed, 2026).

Challenges Faced by Pakistan in Transitioning to a Green Economy

- ✓ **Financial Constraints:** Limited access to funding is a major obstacle and hurdle in achieving sustainable economy with healthy environment. Investment of green technologies demands very high capital to invest as for Pakistan developing country that face issues like poverty unemployment it is one of major challenge for state.
- ✓ **Policy Framework:** In state of Pakistan the lack of cohesive policies & regulatory frameworks hampers, hinder the development and growth of renewable energy projects.
- ✓ **Infrastructure Deficits:** According to Pakistan Bureau of Statistics, 2023 census the Pakistan rural, population is 150-155 million approximately 61 % and with Inadequate infrastructure, particularly in the rural areas, poses challenges to implementing green solutions effectively, hinders the successful implication.
- ✓ **Socio-Economic Factors:** The existing social inequalities, are major barriers to the sustainable development, can complicated implementation efforts, as marginalized communities may be left behind.
- ✓ **Educational Gaps:** A lack of awareness and education about sustainability practices limits public engagement, support as most of people are not aware of sustainability along with the environmental protection. And lack of awareness caused reduction in public participation in particular context.

Opportunities for Pakistan's Green Economy Transition

- ✓ **Renewable Energy Potential:** Pakistan has immense potential for the solar energy as receives high sunlight throughout year (5–7 kWh/m^2/day in many regions), Wind energy in Coastal areas (Sindh and Baluchistan) can also produce around 50,000 MW electricity potential, Hydropower as Pakistan has rivers like Indus river system, with the 30,000+ MW potential, which can reduce dependency upon the fossil fuels and promote the sustainable ecofriendly development.
- ✓ **Job Creation:** Transitioning to the green economy can leads to the creation of new jobs like Solar panel installation and maintenance, Wind energy projects & Eco-tourism in (northern areas, coastal regions). According to International Labor organization transition toward green economy can lead to creation of millions of jobs globally and Pakistan has high rate of young population could get benefit. Sustainable farming and organic agriculture in sectors such as solar energy, eco-tourism, as well as the sustainable agriculture (Asghar, Muzaffar, Farooq, & Rasheed, 2026).
- ✓ **International Funding:** Pakistan can access global funds like Green Climate Fund (GCF) from World Bank climate projects and UN climate financing programs Pakistan received climate adaptation and disaster recovery funding from international donors due to its vulnerability to climate risk that focused on sustainable development & climate resilience leading toward sustainable development.

- ✓ Environmental Restoration: Investment in reforestation and biodiversity conservation, can combat environmental degradations and improve livelihoods as Pakistan is already working on environmental protections like Billion Tree Tsunami Project (KPK) planted over 1 billion of trees, Mangrove restoration in Sindh coastal areas & Wildlife protection projects in northern regions of Pakistan because Forests helps to reduce floods, soil erosion, improve livelihoods of rural communities.
- ✓ Enhanced Global Standing: The commitment to sustainability & development can improved Pakistan's image on the international stage, attracting foreign investment & correspondingly Strengthens relations under the Paris Climate Agreement commitments (Rasheed, Asghar, & Farooq, 2026).

Successful Green Initiatives in Pakistan as transition

Table 1 Several Initiatives Highlighted the Potential of Green Practices:

Project Name	Description	Impact
Pakistan's Billion Tree Tsunami	A reforestation project aimed at planting one billion trees.	Restored ecosystems and increased carbon sequestration.
Net Metering Initiative	Encourages households to install solar panels and sell excess energy back to the grid.	Promotes renewable energy uptake among citizens.
Green Pakistan Program	Aims to enhance forest cover and promote sustainable forestry	Improved forest health and biodiversity conservation

Benefits of Transitioning to a Green Economy

Table 2 The Transition to a Green Economy Brought Various Benefits, Including:

No.	Benefits	Explanation
1	Environmental Sustainability	Mitigation of climate change and impacts preservation of natural resources increase the environmental sustainability.
2	Economic Resilience	Diversifying the economy reduces vulnerability to global market fluctuations.
3	Public Health Improvements	Cleaner air and water reduce health-related issues caused by pollution.
4	Energy Security	Increased use of renewable energy sources enhances energy independence.

CONCLUSION

Pakistan's transition to a green economy is not just compulsory for combating climate change but it presents significant opportunities for growth, innovation, improved quality of life. By confronting the difficulties of the front on and harnessing, and existing resources, Pakistan may pave the road, for sustainable future. It is critical thing one of that all stakeholders, government, corporations, and individuals should work together to create a more environmentally, sustainable economy. Together, we can build a more resilient and vibrant ecosystem, for good future generations. To summarize, the

transition towards a green economy is not an option now, but rather a need at this time, not only for Pakistan current well-being but for existence of future generations of Pakistan. Pakistan assurance to the Paris Agreement elaborated necessity of taking urgent action on climate change issues that affect whole country.

Recommendations & Future Research Directions

- ✓ Encourage regional sustainable companies and goods, promote legislative changes and more government backing for renewable energy projects.
- ✓ Take part in environmental conservation and reforestation initiatives, Inform yourself and others on the advantages of sustainable activities.
- ✓ Strengthen the research & innovation regarding climate smart technologies and renewable energy and sustainable development.
- ✓ Should Encouraging Private Sector Participation like Industries by incentivized to adopt cleaner production technologies, and reduce the emissions, as well as to shift toward circular economy models.
- ✓ Improve the rural infrastructure and increased the public awareness on this issue as well as environmental education should added to all studies and increase the public participation to reduce the climate issue.
- ✓ In future researcher should employ quantitative techniques to know public opinion about green economy. And to check how much green economy initiatives are helpful in climate mitigating in Pakistan. The future study should employ comparative analysis between sole welfare state and Pakistan.

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