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FROM CRISIS TO RESILIENCE: CLIMATE CHANGE, ENVIRONMENTAL POLICY, AND SUSTAINABLE ADAPTATION IN PAKISTAN

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Abstract
This research addresses the latest problems of global warming and how they affect the environmental status of one of the countries that are hit by climate disasters, Pakistan, in which there are repeated floods, droughts, and degradation of natural ecosystems. It discusses environmental policy and climate change, the institutional and legal setup for natural resource management, and their evaluation based on effectiveness to manage them. Its socioeconomic aspects of climate change are also taken into account, enforcing the need for immediate government intervention in the reduction of risk and enhancement of community resilience. Scarcity of water, unpredictable weather, and heat stress were behind rural poverty, decreased farm production, and undermined food security. Urbanization and industrialization increased pressures on natural resources, causing deforestation and Herculean air pollution. Shift towards renewable energy, afforestation drives, and bottom-up adaptation policy intervention are the calls of the times for conservation of the environment of Pakistan and securing long-term socioeconomic stability on evidence-based policy intervention.

Keywords: climate change, environmental degradation, Pakistan, policy frameworks, resilience

Introduction

Climate change is one of the most significant global issues of the twenty-first century, having profound impacts on the health of citizens, economic stability, and environmental sustainability (Suleri, 2022). The socioeconomic constraints, geographical exposure, and dependence of the nation on climate-sensitive sectors like agriculture and water resources critically affect climate change in the country (Mirza & Ahmed, 2023). Climate calamities include floods that devastate the world, droughts for six months, unstable weather conditions, more water scarcity, livelihood disruption, and growing socioeconomic inequalities. This trend has significantly been experienced in Pakistan in the past ten years. The issues underscore the profound degree to which the integrated plans can help mitigate the impacts of climate change and increase the resilience of populations put under threat at present (Sheikh, 2023).

For meaningful policy interventions in Pakistan, environmental management and climate change interaction is crucial (Amir, 2022). The depth and width of the impending climate dangers are usually underestimated by institutional and legal provisions that now govern natural resources (Najam & Yusuf, 2023). For sustainable management of resources, preservation of ecosystems, and protection of vulnerable populations, they are all essential for improving these provisions. Besides, incorporating scientific research into policymaking will promote evidence-based approaches with increased resilience and sustainability (Bhatti & Anwar, 2022).

In response to the effects of climate change in Pakistan, cooperation between

ISSN E: 2709-8273
ISSN P:2709-8265
JOURNAL OF APPLIED LINGUISTICS AND TESOL
JALT

government institutions, non-governmental organizations (NGOs), and local communities is essential (Aslam et al., 2022). Cooperation can facilitate the development of solutions, improve adaptive capacity, and make climate action plans equitable and just (Venkatramanan et al., 2023). For example, locally, community-level adaptation measures have worked towards fostering sustainable interventions like afforestation and water harvesting (Amish et al., 2024).

Research Justification

Policy reforms overall and scientific input into decision-making are required to address these issues. The research aims to determine Pakistan's most pressing environmental issues, assess existing regulations, and provide long-term solutions. In order to help equip policymakers and stakeholders with actionable information that will enhance the system to frustrate climate risks, the research aims to improve understanding of climate change and its potential future impact on Pakistan through a comparison of global and domestic perspectives.

Actually, the floods of 2022, which left millions homeless, made more urgent the call for both stronger environmental legislation along increased risk reduction mechanisms. All this really serves to underscore the reality that climate change must necessarily be a national agenda. Pakistan stands extremely vulnerable to climate hazards owing to its geography and socioeconomic exposures. However, the nation has not geared up for such risks since the environmental laws that are in place have poor enforcement mechanisms. Environmental regulatory loopholes, governance issues, and financial shortages are holding back Pakistan from addressing the climate problems.

Policy changes in general and science inputs to policymaking are essential to overcome these challenges. The research aims to determine the most critical environmental issues in Pakistan, assess existing laws, and provide long-term solutions. In order to help formulate policymakers and stakeholders with actionable information in order to enhance the system to counteract climate threats, the research aims to advance the understanding of climate change and the way it may affect Pakistan in the long run through a discussion of international and local perspectives.

Research Methodology

This study employed a systematic review methodology, with research objectives established accordingly. A comprehensive literature review was conducted (Komba & Lwoga, 2020). Research findings were categorized based on their content (Hiver et al., 2021; Petticrew & Roberts, 2006), and classified information was incorporated into the study by organizing it into headings (Gan et al., 2021; Pawson et al., 2005). The evaluation of classified information and titles formed the basis of the study (Page, 2021; Rahi, 2017), ensuring the integrity of the research subject and its contents (Egger et al., 2022; Victor, 2008). The criteria for selection are enlisted.

1. **Relevance:** Research that directly addressed the questions posed by this study is included.
2. **Quality:** Studies that meet a certain quality threshold (e.g., methodological rigor, bias risk) are included. Most of the research is from Scopus-indexed and Clarivate Analytics journals and reputed publishers.
3. **Recency:** Consideration of the publication date to ensure that the review reflects the most current evidence. Most of the studies are from the last three years.
4. **Language:** Only studies published in English are included.
5. **Data Completeness:** Previous studies must provide sufficient data on outcomes of

ISSN E: 2709-8273
ISSN P:2709-8265
JOURNAL OF APPLIED LINGUISTICS AND TESOL
JALT

interest for practical synthesis; it is also ensured in this research.

This study did not use primary data from human participants; therefore, no ethics clearance letter from the ethics committee was required.

Literature Review

Climate change is likely the most significant problem of the twenty-first century, and its catastrophic implications on public health, economic stability, and sustainability of the environment are well established (Ullah & Bashir, 2024). It is larger there due to exposure to geography, exposure due to socioeconomic factors, and greater dependency on climate-sensitive sectors such as agriculture and water resources (Khan et al., 2024). Torrential floods, chronic droughts, and unstable weather patterns have increased climate-related disasters in Pakistan over the past decade, not only increasing water scarcity and derailing livelihoods but also amplifying socioeconomic inequalities (Shirazi & Hussain, 2022). All these clearly become the reasons why robust interventions to counter climate change impacts and build community resilience are critically needed.

Effective policy interventions in Pakistan in regard to climate change and environmental management require awareness of the interlink between these phenomena. Climate risks are often passed through or overlooked by institutional and legal mechanisms settled for resource management in Pakistan (Amir, 2022). The systems have to be made more robust to sustain resource management and preserve the ecosystems as well as protect vulnerable sections of society (Najam & Yusuf, 2023). Incorporating scientific research into policy is also necessary for developing evidence-based policies to promote resilience and sustainable development (Bashir & Ali, 2024). Without incorporating such scientific research into policy, responses by policies toward the many climate change issues may continue to be piecemeal or inadequate.

Coordinating between local communities, NGOs, and government organizations will help to achieve the impact of climate change in Pakistan (Aslam et al., 2022). Cooperation can facilitate innovative solutions, enhance adaptive capacity, and ensure inclusive and equitable climate action plans (Vighio, 2024). For example, where climate change effects are most significant, local adaptation practices have been shown to foster resilience through the execution of community-based adaptation strategies (Amish et al., 2024). These efforts mainly utilize the participatory approach where the local people's efforts in coping with the prevailing conditions are their own and, hence, more sustainable and efficient (Moin, 2024).

Climate change in Pakistan has enormous socioeconomic impacts on public health, water security, and agricultural sectors. Agriculture is absorbed by 40% of the workforce, which is incredibly vulnerable to climatic variability. Reduced production of food and crops is because of erratic patterns of increased temperature in rainfall (Mirza & Ahmed, 2023). Already, limited supplies of water in semi-arid and arid regions are further stressed due to climate change, resulting in a critical problem of water security (Venkatramanan et al., 2023). Climate change also presents a threat to the public by the premature beginning of heat-related illnesses, vector-borne diseases, and malnutrition (Riaz & Rehman, 2022). Climate adaptation should be included in national development plans to address these issues.

The literature suggests that Pakistan needs concerted and integrated action toward handling climatic change issues. Pakistan can develop its resilience toward climate change and achieve sustainable development through initiatives at robust legislative and institutional frameworks (Sheikh, 2023), incorporating scientific evidence in policies (Suleri, 2022), and inter-stakeholder engagement (Amir, 2022). In order to deescalate the impacts of climate change and for the future of the nation, this review identifies with paramount importance

ISSN E: 2709-8273
ISSN P:2709-8265
JOURNAL OF APPLIED LINGUISTICS AND TESOL

evidence-based policies and practices for all.

Historical Context of Pakistan's Climate and Environmental Policies

Historically, Pakistan's reaction to environmental degradation and climatic change has undergone a revolutionary change over the years. The Pakistan Environmental Protection Agency (EPA) was the spin-off of the breakdown of the first wave-like attempt at addressing environmental problems, the Pakistan Environmental Protection Ordinance (PEPO) of 1983 (Ullah & Bashir, 2024). PEPO was replaced in 1997 with the Pakistan Environmental Protection Act (PEPA), which enforced Environmental Impact Assessments (EIAs), stronger environmental regulations, and decentralized decision-making with provincial EPAs (Amir, 2022). Its success, weak compliance, and less effective environmental governance in the federal and provincial governments were weakened by poor funding, bureaucratic inefficiency, and improper enforcement (Bashir & Ali, 2024).

For adaptation and mitigation activities regulation, the Climate Change Act (2017) created the Climate Change Council and Climate Change Authority that brought Pakistan to the level of international frameworks like the Paris Agreement and Sustainable Development Goals (SDGs) (Venkatramanan et al., 2023). Other than this, Pakistan is also a beneficiary of global climate finance, e.g., the Green Climate Fund, which funds adaptation projects aimed at hunger and climate change vulnerability to agriculture (Bhatti & Anwar, 2022). Even in Pakistan itself, where climatic change effects like water and destructive storm shortages are most severe, implementation problems still occur, more especially at the lower levels (Amish et al., 2024).

Theoretical Context of Climate and Environmental Protection Laws

Environmental justice and sustainable development are the theoretical bases of climate and environmental protection policy in an effort to balance nature conservation, economic development, and social fairness. Multilateral diplomatic efforts towards climate change mitigation and resources management, e.g., the Paris Agreement and the United Nations Framework Convention on Climate Change (UNFCCC), are rooted in them. These global norms have trickled down to inform national policy in Pakistan, including the Climate Change Act of 2017 and the National Climate Change Policy of 2012, which prioritizes climate resilience in development planning.

Polluter pays and precautionary principles, legislating prevention and liability for pollution, are the foundations of climate law. Laws such as the 1997 Pakistan Environmental Protection Act (PEPA) mandating environmental impact assessments (EIAs) on development plans implement such principles. A lack of checks and institutional capacity hinders them. The principle of intergenerational justice drafts the burden placed on current generations to preserve nature for future generations. With such advancement, the gap between policymaking and implementation emphasizes the need for greater governance and public engagement. Institutionalized frameworks and improved public involvement are required to close the intention-to-policy implementation gap.

Environmental Protection Laws in Pakistan

The majority of the principal climate change and environmental protection legislation has been passed into law by Pakistan. It is to pave the way for climate change resilience, foster sustainable development, and reduce environmental degradation.

1. **Forestry Act, 1927:** This act presents a solution for the problem of deforestation and promotes afforestation with a focus on regulating forests and promoting sustainable forest management, which is vital for carbon sequestration and biodiversity conservation.
2. **Environmental Protection Act (PEPA), 1997:** It created Pakistan's Environmental Protection Agency (EPA), which would carry out environmental impact assessments (EIAs),

ISSN E: 2709-8273
ISSN P:2709-8265
JOURNAL OF APPLIED LINGUISTICS AND TESOL
JALT

ensure the application of the law, and follow sustainable development. The ecological issue should be integrated into development plans to prevent the effects of climate change.

3. **The 2012 National Climate Change Policy:** This is a strategy to guide disaster risk reduction, sustainable development, and public participation in climate action. It highlights how important good management of resources and climate-resilient infrastructure are.

4. **Climate Change Act, 2017:** The legislation deals with deforestation and promotes afforestation with the goal of managing forest cover and improving sustainable practices vital for biodiversity conservation and carbon sequestration.

5. **2019's Alternative and Renewable Energy Policy:** The policy promotes the utilization of renewable sources of energy, such as hydropower, wind, and solar energy, that reduces the use of fossil fuels and carbon emissions.

Challenges for Climate and Environmental Laws in Pakistan

1. Inadequate Law Enforcement: Poor enforcement of available law is perhaps Pakistan's largest climate and environmental governance problem. Although there is sound legal legislation in place - which includes the Climate Change Act 2017 as well as the Pakistan Environmental Protection Act (PEPA) 1997 - their implementation is hampered by inefficiency within institutions and the absence of coordination between government departments. Industry does not heed emission standards, and economic activities continue without proper environmental impact assessments (EIAs), which further exacerbate ecological degradation. The country is not able to cope with climate issues because the limited budget and resources of environmental protection agencies also hamper enforcement.

2. Lack of Public Awareness and Involvement: Most communities, especially rural communities, have limited knowledge regarding environmental rights and duties under environmental law. Limited awareness makes their capacities to hold polluters accountable and to instill sustainable practices less effective. Low levels of literacy and awareness also similarly undermine the practical application of environmental and climatic policies. While minorities such as indigenous peoples and women are most affected by climate change and environmental degradation, they are not usually part of the decision-making process. Ineffective piecemeal climate action follows without the active engagement of communities.

3. Socioeconomic Constraints: Pakistan is more vulnerable to the effects of climate change as it is dependent on climate-sensitive sectors such as water and agriculture. The impacts are food poverty, water scarcity, and reduced agricultural production because of increased temperature, unpredictable rainfalls, and frequent drought in arid and semi-arid regions. Urbanization, poverty, and high population growth, which further deteriorate natural resources, further baffle sustainable development. Environmental degradation is also worsened by heightened urbanization, which tends to result in deforestation and land utilization for farming. Environmental degradation raises climatic vulnerabilities, and hence, the enforcement of policies and legislation that seek to contain these challenges becomes even more challenging. These socioeconomic challenges create a vicious cycle.

4. Political and Governance Issues: Environmental initiatives are typically weakened by bureaucratic red tape, corruption, and political instability. The weak national response to climate change adaptation and mitigation has resulted in fragmented and uneven policies that do not tackle the root causes of environmental degradation. For instance, Pakistan has made significant commitments under global agreements like the Paris Agreement, yet these are yet to be effectively translated into national and local policy. Political instability and weak governance also remain obstacles to exemplary implementation of climate and environmental policy.

5. Climate Change: Climate change raises the challenge of environmental regulations.

ISSN E: 2709-8273
ISSN P:2709-8265
JOURNAL OF APPLIED LINGUISTICS AND TESOL
JALT

Institutions are coming under increasing pressure to adapt effectively as extreme weather conditions - such as heat waves, droughts, and floods - are becoming more intense and more frequent. Apart from the immediate devastation, such incidents divert funds away from long-term environmental conservation. For example, the 2022 catastrophic floods displaced millions of individuals and necessitated mass relief efforts, leaving little space to implement environmental laws. It creates a vicious cycle where climatic vulnerabilities are amplified because of ecological degradation, and it is challenging to apply rules and policies to mitigate these factors.

Opportunities for Climate and Environmental Laws in Pakistan

1. Conduct Policy Reforms: Top-level policy reforms are warranted to address high-level systemic problems in Pakistan's climate policy. There can be increased transparency and accountability in dealing with the environment through increased enforcement of the current law, e.g., the Climate Change Act of 2017 and Pakistan's Environmental Protection Act (PEPA). Pakistan can combat climate risk more effectively through more regulation of the sector, mandating EIAs on economic projects, and ensuring international accords such as the Paris Agreement are given effect. Climate resilience can also be mainstreamed in national and provincial plans so that all sectors, from urban planning to agriculture, place the highest priority on climate adaptation.

2. Development of Renewable Energy: Pakistan has a tremendous opportunity to move out from fossil fuels and greenhouse gases by encouraging the development of renewable energy. With the availability of hydropower, wind, and solar energy resources, there can be the establishment of a clean energy portfolio. Through investment promotion and technological advancements, state policies like the Alternative and Renewable Energy Policy (2019) are attempting to induce the share of renewables in the energy sector. With investment incentives and assistance to the private sector for renewable projects, Pakistan can achieve economic and environmental advantages through lower energy prices, job creation, and prevention of climate change.

3. Public Awareness and Community Engagement: Strengthening the enforcement of environmental law involves strengthening the community through awareness and education programs. Most communities, particularly rural communities, are unaware of their rights and responsibilities under environmental legislation, and it is, hence, challenging for them to develop sustainable practices or prosecute environmental criminals. Ecological conservation, sustainable resource management, and climate risks can be communicated to the public through national campaigns. Water conservation and plantation drives are among the people-centered adaptation strategies already in place, with encouraging outcomes in enhancing neighborhood resilience. They can be replicated and amplified for long-term effects.

4. Technological Advancements: Community resilience can be fortified with environmental law enforcement by consolidating sensitization and education programs. Most communities, particularly rural communities, are not aware of their responsibilities and entitlements under ecological policies. Therefore, it is hard for them to promote sustainable activities or pursue culprits of the environment. The public can acquire environmental protection, sustainability management of natural resources, and climate hazards through nationwide campaigns. Water-saving measures and plantation drives are among the community-level adaptation strategies already found to be working in enhancing neighborhood resilience and can be replicated on a larger scale.

ISSN E: 2709-8273
ISSN P:2709-8265
JOURNAL OF APPLIED LINGUISTICS AND TESOL
JALT

5. Global Partnerships and Financing: Enhanced collaboration with international institutions is necessary to bridge the financial as well as technical limitations to climate action. International institutions like the World Bank and the UN provide finance and technical support to climate change mitigation and adaptation efforts. The Green Climate Fund (GCF) has funded some Pakistan projects on sustainable development and climate resilience. With these resources and support for collaboration with international actors, Pakistan can enhance its institutional capacity, strengthen the enforcement of its environmental laws, and align its climate ambitions with international standards.

6. Institutional Coordination and Governance: Effectiveness and coherence can be enhanced by establishing a central agency of environmental and climate policy between the federal and provincial governments. Improved institutional coordination has two advantages: overcoming policies that are fragmented and enhancing the implementation of climate change programs. Pakistan's environmental legislation can keep pace with emerging issues and international practices through periodic review and revision. For effective climate action, we must fight corruption, cut red tape, and establish robust institutions of governance.

Discussion

The findings of the present study disclose the extent to which interrelated pollution, global warming, and poverty in Pakistan. Poverty, unusual weather, and lack of water are some of the climatic consequences to which the country is highly vulnerable because of its geographical position and dependence on climate-sensitive industries. Severe droughts, unstable rains, and temperatures all impacted crops, threatening lives and food security, mostly in rural areas. Industrialization and urbanization imposed stresses on natural resources, leading to deforestation and air and water pollution. All of the above are a result of unawareness, socioeconomic constraints, and weak enforcement of environmental regulations. Development plans, for example, proceed without the necessary environmental impact studies (EIAs), and industries disregard emission limits, further degrading the environment.

There exist, nevertheless, numerous methods to increase Pakistan's dominance over the climate. A solid basis for the translation of national policy to international best practice is the use of global frameworks such as the SDGs and the Paris Agreement. An environmentally cleaner source compared to fossil fuels, the use of sources such as solar, wind, and hydropower minimizes greenhouse emissions but creates new business prospects. Successfully implemented adaptation efforts like afforestation and water harvesting are also undertaken among the rural population and can be replicated to the highest level of climate resilience. Even with more government transparency to be anticipated through blockchain technology, technologies like geographic information systems (GIS) and telemetry can be applied to escalate the level of environmental monitoring and compliance.

Technical and funding issues must be resolved by international cooperation and investment, specifically by multilateral development institutions such as the World Bank and the Green Climate Fund (GCF). For instance, the GCF funds various projects in Pakistan for sustainable development and climate resilience. There are enormous opportunities for Pakistan to enhance its climate governance, although it has plenty of challenges. Strengthening the capacities of the nation to deal with climate issues and partake in sustainable development will need to be accomplished in collaboration between the government, civic society, and the global community.

Conclusion

For Pakistan, collaborative efforts on climate change and environmental issues remain utterly crucial, and this research certainly drives that point home. We only need to look at the horrific 2022 floods to grasp Pakistan's vulnerability to climate-related disasters. Beyond the

ISSN E: 2709-8273
ISSN P:2709-8265
JOURNAL OF APPLIED LINGUISTICS AND TESOL
JALT

floods, think about the recurring droughts and those brutal heat waves; they've touched countless lives and seriously thrown off people's ability to make a living. Socioeconomic factors are really hamstringing things, too. You see poverty and rapid urbanization, not to mention how poorly environmental laws are enforced. All these things are major roadblocks when it comes to putting effective policies in place. That said, there is hope! Community-based projects could be a real game-changer, and shifting to renewable energy is a must.

Pakistan Alternative and Renewable Energy Policy (2019) is promoting wind and solar energy schemes in order to provide green options for fossil fuels. Local resilience has been increased effectively through such community-based schemes as water harvesting and afforestation. Pakistan has to enhance the institution, enhance international collaborations, and enhance public awareness through national awareness campaigns to achieve these opportunities. Pakistan can counteract the impact of climate change and achieve its environmental targets if it embraces technology and coordinates policies with the best in the world. It needs to collaborate with the government, civil society, and the global community to have a sustainable future.

Recommendations

1. Strengthen Enforcement Mechanisms: The use of additional funds, training, and equipment by environmental protection agencies would enable them to more effectively enforce legislation such as the Climate Change Act of 2017 and the Pakistan Environmental Protection Act (PEPA) of 1997.

2. Promote Public Awareness: Initiate nationwide campaigns to raise awareness among communities regarding their rights and obligations under environmental law, with special emphasis on marginalized communities like women and indigenous peoples.

3. Incorporate Climate Resilience into Development Planning: Ensure that climate resilience is given priority across all sectors by aligning national and provincial development plans with the National Climate Change Policy 2012.

4. Invest in Renewable Energy: By providing incentives to private sector investment and by adopting the Alternative and Renewable Energy Policy 2019, you can accelerate the transition to renewable sources of energy such as solar, wind, and hydropower.

5. Strengthen Community-Based Adaptation: Expand community-based adaptation initiatives that enable adjoining communities to adopt sustainable afforestation and water conservation practices.

6. Leverage Technology for Environmental Monitoring: To improve environmental regulation monitoring and enforcement, utilize digital technologies such as remote sensing and geographic information systems (GIS).

7. Encourage International Cooperation: To secure funding and technical support for climate change mitigation and adaptation interventions and increase collaboration with multilateral organizations such as the World Bank and the Green Climate Fund (GCF).

8. Enhance Institutional Coordination: Create a single point to foster consistency and efficacy in the federal and provincial governments' climate and environmental programs.

9. Promote Private Sector Involvement: Establish public-private partnerships to drive innovation and sustainability in sectors such as waste management, energy, and agriculture.

10. Conduct Regular Policy Reviews: Update and review environmental and climate policies on a regular basis to reflect emerging concerns, technological innovations, and international best practices.

Research Limitations

The study is focused on Pakistan, and, well, you have to wonder how well the

ISSN E: 2709-8273
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JOURNAL OF APPLIED LINGUISTICS AND TESOL

findings translate to other places. Places that are just different, you know? Countries with stronger institutions, for example, or even countries that haven't faced the same climate challenges. Those places might need completely different solutions than what we've proposed for Pakistan. Ultimately, additional research would be required to determine the extent to which our recommendations could apply in those contexts. Secondly, secondary data reliability is prone to bias and gaps since some of these sources may be outdated or incomplete. For instance, evidence is likely to be missing in studies if recent innovation or local experiences cannot be explicitly reflected within government reports and foreign studies.

Additionally, time limitation restricts the extent of data collection, especially in the case of primary research in the form of interviews or surveys. Personal interaction with the stakeholders, such as legislators, environmentalists, and residents, would have been achievable with additional time to gather first-hand data. Finally, institutional barriers, including bureaucratic hurdles or limited availability of particular datasets, also restrict access to the data.

Research Implications

Some of the implications of climate change research and the environmental issues of Pakistan are:

1. Policy reform: Implications can inform the formulation of good climate policies, for example, by enhancing the National Climate Change Policy and enhancing the enforcement of environmental legislation.

2. Community resilience: The local communities can utilize information on climate adaptation techniques to implement resilient measures like water harvesting and afforestation.

3. Transition to renewable energy: Science can guide action to spur the production of wind, hydropower, and solar power and move towards decreased dependence on fossil fuels and greenhouse gas emissions.

4. Public awareness: By emphasizing the socioeconomic effects of global warming, national campaigns can be launched to educate residents about their legal rights and liabilities under environmental legislation.

5. International cooperation: By identifying vulnerabilities in climate management, alliances with international organizations, such as the Green Climate Fund, can be strengthened to obtain funds and technical assistance for projects that will enhance climate resilience.

Future Research Directions

Any future research study on Pakistan's environment and climate change can concentrate on several focused areas to bridge the gaps and enhance governance:

1. Adaptation strategies in climate: Analyzing the efficacy and replicability of rural-scale adaptations.

2. Integration of renewable energy: the value of the environment and socioeconomic benefits of shifting to renewable forms of energy, i.e., solar and wind, and determining barriers to uptake.

3. Water resource management: Studying the impact of climate change on water scarcity and proposing water management for sustainable use in urban and agriculture.

4. Gaps in policy implementation: Confirmation of the way the current environmental law, i.e., Pakistan Environmental Protection Act (PEPA), is being implemented and the institutional lacunas.

ISSN E: 2709-8273
ISSN P:2709-8265
JOURNAL OF APPLIED LINGUISTICS AND TESOL
JALT

5. **Gender and climate vulnerability:** Examining the ways in which climate change disproportionately affects women and vulnerable people and ensuring gender-sensitive adaptation plans.
6. **Technological innovations:** Evaluating how blockchain, remote sensing, and GIS can help support environmental monitoring and governance.

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