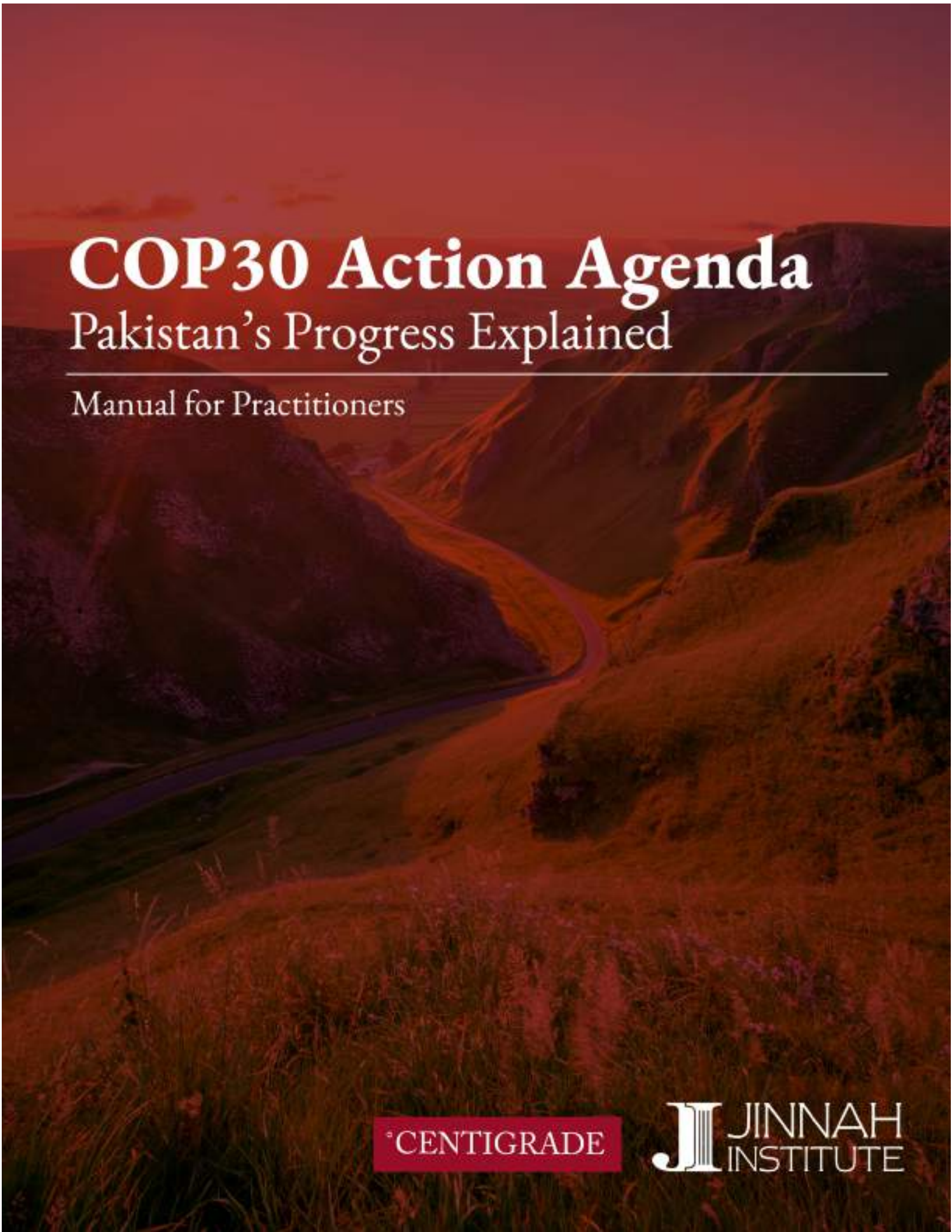
COP30 Action Agenda

Pakistan's Progress Explained

Manual for Practitioners



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COP30 Action Agenda:
Pakistan's Progress Explained

November 2025

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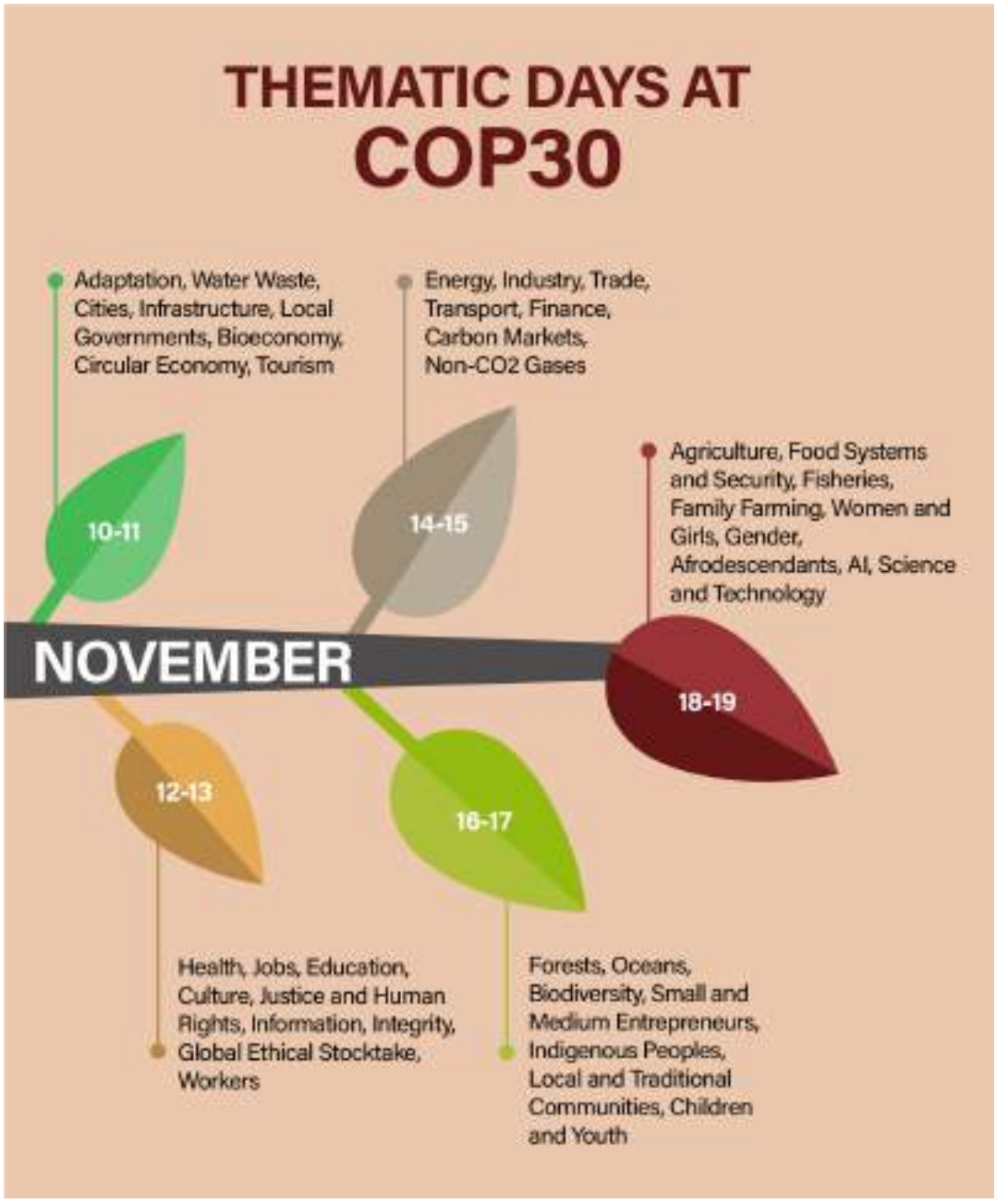
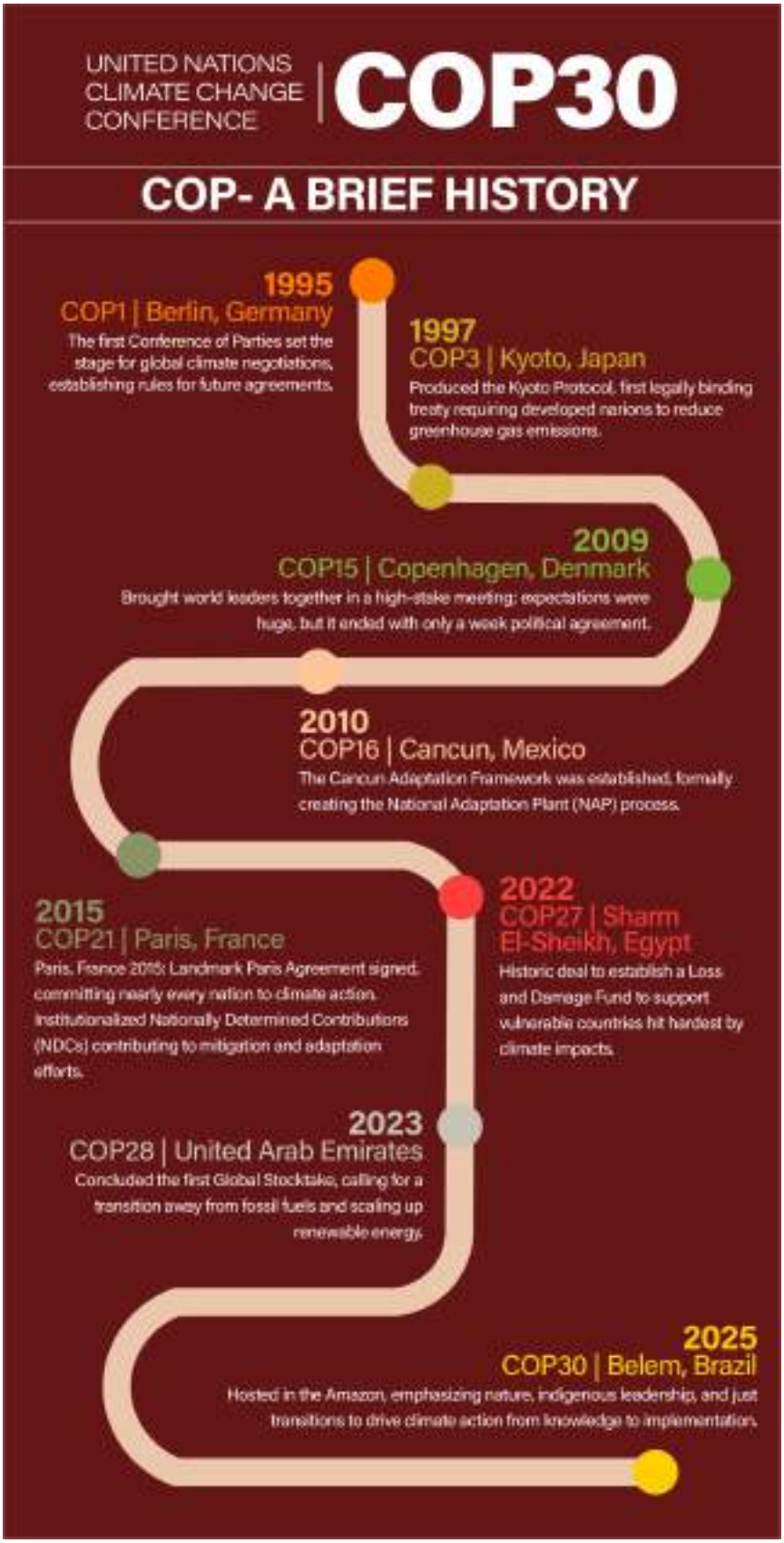
COP30's Six Action Agenda

Organised around six key "Axes," the Action Agenda will bring coalitions together, share experiences, and scale up collective efforts: within these, there are further divisions into 30 key objectives designed to elevate climate action. These are as follows:



Source: Columbia Climate School



Source: Columbia Climate School

Pakistan Nationally Determined Contributions 2.0 and 3.0

Category	NDC 2.0 (Updated 2021)	NDC 3.0 (2025)
Target Year	2030	2035
Overall Mitigation Target	50% reduction in projected 2030 emissions (15% domestic + 35% conditional on support)	50% reduction by 2035 (17% domestic + 33% conditional)
Projected BAU Emissions	1,603 Mt CO_2e by 2030	2,559 Mt CO_2e by 2035
Target Reduction (Mt CO_2e)	-801 Mt (50%)	-1,280 Mt (50%)
Financial Requirement	US $101 billion by 2030 (for energy transition alone	US $565.7 billion (US $348 billion to 2030 + US $217.7 billion 2030–35)
Energy Sector Target	60% of energy from renewables incl. hydro by 2030	62–69% clean/renewable energy capacity by 2035 (IGCEP 2025–2035)
Transport	30% of new vehicles electric by 2030	30% EV sales + 3,000 charging stations by 2030
Coal Policy	Moratorium on new imported coal power, shift to hydro & gasification	Gradual fossil phase-down – gas & furnace oil decline (–2,147 MW, –430 MW)
Forestry & Bio Diversity	TBTTP, BTAP to sequester 500 Mt CO_2e by 2040	Upscale Green Pakistan Programme (UGPP); Restore 30% of degraded habitats by 2030
Waste Sector	Clean Green Pakistan Index; WASH integration	17% emission reduction via integrated waste management
Adaptation Priority	Focused on water, agriculture, health, forests	Central pillar – NAP 2023 integration; sector-wise targets
Main Policy Alignment	NCCP (2012, updated 2021), ARE 2019, NEVP 2019, IGCEP 2021–30	NCCP 2021, PCCA 2017, URAAN Plan 2024–29, IGCEP 2025–35

Source: NDC 2.0, NDC 3.0

Climate Targets - 2025 NDC Targets submitted since November 2024
Only 65 countries have submitted a 2035 NDC target
128 countries have not submitted a 2035 NDC target
35.7% Global Emissions covered by 2035 NDC submission
32.0% Global Population covered by 2035 NDC submission

Source: Climate Action Tracker (CAT) 2035 Climate Target Update Tracker

Climate Finance Needs and Progress

#1

CRI 2025 ranks Pakistan first among most affected countires by extreme weather events in 2022

<1%

Pakistan's contribution of Global Carbon Emissions

$ 40-50B

Amount Pakistan requires annually to meet its climate adaptation and mitigation needs

$ 2-3B

Amount Pakistan currently receives annually

Source: Climate Finance Pakistan (CFP)

Source: Climate Finance Pakistan (CFP)

State of Loss and Damage Fund	
Total L&D funding needs for 2025	USD 395 bn
FRLD signed contributions	USD 0.560 bn
FRLD unsigned pledges	USD 0218 bn
FRLD total pledges and contributions	USD 0.788 bn
FRLD total resources received	USD 0.367 bn

Source: Fund for Responding to Loss and Damage (FRLD)

Energy, Industry & Transport

1.1: Tripling renewables and doubling energy efficiency

Global & COP30 context

The first key objective listed in the Action Agenda for COP30 is 'Tripling renewable energy capacity globally and doubling the global average annual rate of energy efficiency improvements by 2030,' a goal that the International Energy Agency (IEA) has deemed "ambitious but achievable".[1] This is something that governments agreed to do at COP28, but tripling renewables in line with the 1.5°C temperature limit would require $12 trillion of investment in the power system up until 2030, and so far it is set to increase to $3.3 trillion.[2][3] To reach this target, global renewable capacity needs to grow to 11.5 TW by 2030, for which Asia is currently making the largest contribution, providing about half (47 per cent) of the capacity additions needed globally by 2030.[4]

Tripling renewables and doubling efficiency will deliver 85 per cent of the cuts in unabated fossil fuels required by 2030 as the energy sector produces 75.7 per cent of the total greenhouse gas emissions, making energy transition the single largest mitigation lever.[5] By 2035, renewables and efficiency will alone more than halve total CO2 emissions, unlocking a fossil fuel phaseout.[6] Clean energy investment topped USD approximately 2.2 trillion recently and solar PV is the single largest item in 2025 investment (approximately USD 450 billion expected for solar in 2025).

Pakistan's progress & challenges

By 2035, renewable energy (including hydropower) and clean energy are expected to reach about 38,472 MW and 43,202 MW43, representing around 62% and 69% of the planned capacity mix under IGCEP 2025-203544.[7] This year, the Renewable Energy (RE) share has reached 35.2 per cent, and by 2035,

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[1] International Energy Agency. (n.d.). *COP28: Tripling renewable capacity pledge (Executive Summary)*. Retrieved from https://www.iea.org/reports/cop28-tripling-renewable-capacity-pledge/executive-summary

[2] Climate Analytics. (2024). Tripling renewables by 2030: Interpreting the global goal at the regional level. Retrieved from https://climateanalytics.org/publications/tripling-renewables-by-2030-interpreting-the-global-goal-at-the-regional-level

[3] International Energy Agency. (n.d.). *Global energy investment set to rise to $33 trillion in 2025 amid economic uncertainty and energy security concerns*. Retrieved from https://www.iea.org/news/global-energy-investment-set-to-rise-to-33-trillion-in-2025-amid-economic-uncertainty-and-energy-security-concerns

[4] Grant, N., Aboumahboub, T., Welder, L., & Fyson, C. (2024). *Tripling renewables by 2030: Interpreting the global goal at the regional level.* Climate Analytics. Retrieved from https://ca1-clm.edcdn.com/assets/Tripling-renewables-by-2030.pdf

[5] World Resources Institute. (n.d.). 4 charts explain greenhouse gas emissions by countries and sectors. https://www.wri.org/insights/4-charts-explain-greenhouse-gas-emissions-countries-and-sectors

[6] International Energy Agency. (n.d.). *Net Zero Roadmap: A global pathway to keep the 1.5 °C goal in reach.* https://www.iea.org/reports/net-zero-roadmap-a-global-pathway-to-keep-the-15-c-goal-in-reach

[7] https://unfccc.int/sites/default/files/2025-09/Pakistan_NDC3.0_24%20Sep.pdf

renewable energy (including hydropower) and clean energy are expected to represent around 62 and 69 per cent of the planned capacity mix, respectively.[8]

Pakistan's electric grid has transformed, with solar energy to represent 20 per cent of all electricity by 2026.[9] In 2025, solar power accounted for 25 per cent of Pakistan's utility-supplied electricity, which makes it one of fewer than 20 nations globally that have sourced a quarter or more of monthly electricity supplies from solar farms. With nearly half the country's 1.5-2 million tube wells expected to shift to solar, an additional 5.6-7.5 GW of distributed capacity will be added, cutting diesel dependence and lowering agricultural electricity demand by over 34 per cent.[10]

Recommendations

Pakistan should adopt a provincially tailored renewable energy strategy that maximizes local strengths while addressing grid bottlenecks. Khyber Pakhtunkhwa can expand micro and mini-hydropower in rural areas through clear off-grid regulatory frameworks.[11] Sindh should scale its Jhimpir–Gharo wind corridor and expand solar across barren lands, supported by hybrid wind–solar integration.[12] Punjab can accelerate solar deployment especially in South Punjab as its barren land is excellently suited for the development of new solar power plants. The wind potential in Punjab is minimal. Northern parts of Balochistan with moderate temperature and good solar irradiance show the highest solar generation potential especially sites which are close to the existing grid and can be exploited straightaway.

Pakistan should dedicate a large, ring-fenced portion of international and domestic climate finance to transmission upgrades, digital dispatch, and utility-scale storage to convert solar capacity into reliable supply. Global analysis flags around USD 400bn per year currently for grid investment and warns it must nearly double to properly integrate rapidly growing solar/wind. [13]

While solar and wind deployment is expanding, Pakistan's grid investment has lagged. Inadequate transmission, storage, and digital grid management risk energy curtailment and intermittency as variable renewable energy (VRE) scales. Accelerating grid modernization, upgrading dispatch systems, and

[8] Government of Pakistan. (2025, September 24). Pakistan NDC 3.0. United Nations Framework Convention on Climate Change. Retrieved from https://unfccc.int/sites/default/files/2025-09/Pakistan_NDC3.0_24 per cent20Sep.pdf

[9] Shah, J. (2025, October 1). The perfect storm fueling Pakistan's solar boom. World Resources Institute. Retrieved from https://www.wri.org/insights/pakistan-solar-energy-boom

[10] Ibid.

[11] Renewables First. (2024). Pakistan Electricity Review 2024. Retrieved from https://uploads.renewablesfirst.org/Pakistan_Electricity_Review_2024_2_e4acfef4fa.pdf

[12] Government of Khyber Pakhtunkhwa. (2022). Khyber Pakhtunkhwa climate change policy 2022 [Policy document]. https://epakp.gov.pk/wp-content/uploads/2022/09/Khyber-Pakhtunkhwa-Climate-Change-Policy-2022.pdf

[13] International Energy Agency. (n.d.). Recommendation 1: People-centred clean energy transition (from Recommendations of the Global Commission on People-Centred Clean Energy Transitions). Retrieved from https://www.iea.org/reports/recommendations-of-the-global-commission-on-people-centred-clean-energy-transitions/recommendation-1

developing regional transmission corridors must be prioritized to convert renewable potential into reliable power supply and system stability.

The Global North should allocate a defined share of carbon pricing and fossil fuel tax revenues to international finance mechanisms that expand renewable access, technology transfer, and grid modernization in the Global South. Such commitments are essential to enable a fair and equitable energy transition, ensuring Pakistan and other developing economies can pursue low-carbon growth without compromising energy security.

1.2: Accelerating zero- and low-emission technologies in hard-to-abate sectors

Global & COP30 Context

The eight hard-to-abate sectors in scope collectively contribute to around 40 per cent of direct CO2 equivalent (CO2 e) emissions. This includes five heavy industry sectors (steel, cement, aluminium, primary chemicals, and oil and gas) and three heavy transport sectors (aviation, shipping and trucking). There has been a reduction in absolute emissions of hard-to-abate sectors by 0.9 per cent between 2022 and 2023. Five out of eight sectors in scope reduced emissions intensity in the last year, i.e. aluminium, cement, chemicals, aviation and trucking. To gain the required trajectory for net zero, an estimated $30 trillion in additional capital is required by 2050 for the sectors in scope. This figure represents around 45 per cent5 of the total incremental net-zero investment required by 2050. By 2050, industries like shipping, cement and chemicals will need to nearly eliminate their direct emissions, while sectors such as aviation, trucking, and oil and gas will need to reduce direct emissions by 79 per cent, 91 per cent and 91 per cent, respectively. These reductions highlight the significant efforts required across all sectors to achieve net zero, especially in those that face more challenges in reducing emissions.[14]

Pakistan's progress & challenges

The industrial sector is the 3rd largest emitting sector in Pakistan which released 25.76 MtCO2e in 2018 and is responsible for the largest share of energy use at 37.1 percent.[15] NDC 3.0 commits to lowering industrial process emissions through energy efficiency, alternative fuels, clinker substitution and emerging CCUS, but identifies limited concessional finance, high electricity cost and grid unreliability, and weak carbon-management regulation as key barriers.[16] Cement is an important large-scale manufacturing industry that contributes nearly 1 percent to Pakistan's gross domestic product (GDP) annually and accounts for an estimated 25 percent of all industrial primary energy consumption. Energy contributes 60 percent to the total cost of cement production, and cement manufacturing in Pakistan relies on coal as the primary source of energy. More broadly, cement manufacturing accounts for between 65 to 70 percent of industrial coal consumption and at least 49 percent of the country's coal emissions.

[14] World Economic Forum. (2024). *Net-zero industry tracker 2024* [Report]. https://reports.weforum.org/docs/WEF_Net_Zero_Industry_Tracker_2024.pdf

[15] National Energy Efficiency & Conservation Authority (NEECA). (2023). *NEEC policy 2023* [Policy document]. https://data.sbfnetwork.org/sites/default/files/NEEC%2520Policy%25202023-1%2520%281%29.pdf

[16] Saleha Qureshi, Sustainable Development Policy Institute (SDPI). (2024). *Decarbonization for industrialization* [Policy brief]. https://sdpi.org/assets/lib/uploads/policy-brief-saleha.pdf

Recommendations

Developing new or harmonising existing standards for decarbonization technologies. Prioritising the development and adoption of harmonised international standards for measuring and reporting emissions from HAI, including standardised methodologies for LCAs (Life Cycle Assessment).[17]

Early retirement of imported coal power plants can release fiscal space and reduce environmental risks. Establishing a Coal Transition Fund financed through carbon credits and green bonds can support worker reskilling and repurpose plant sites, ensuring a just and orderly shift toward clean energy.[18]

Currently more than 50 per cent of Pakistan's industry is located in Sindh. Promote renewable energy resources to reduce GHG emissions from industries. Control emissions and effluents from the industries by encouraging treatment of industrial waste. Monitor the industrial emissions

Renewables can play a central role in the decarbonisation of all hard to abate sectors. The drastic cost reductions that we have observed in recent years make renewable power the cheapest source of carbon-neutral energy worldwide. Furthermore, there is potential for further cost reductions through technological learning and economies of scale.[19]

Reducing the quantity of clinker in cement by adding other additives like fly ash and blast furnace slag can abate process emissions from the cement subsector; The clinker-to-cement ratio in Pakistan is 0.95 while the global average was 0.72 in 2020. At 0.57 to 0.6, Chinese plants manufacture with the lowest clinker-to-cement ratio. According to the International Energy Agency (IEA), the global average ratio of clinker-to-cement must decrease to 0.65 by 2030 in order to meet net-zero targets.[20]

Given Pakistan's significant biomass production potential (an estimated 25.3 million tons per year), restructuring the fuel mix of the cement industry with alternative fuel options is a realizable possibility. Replacing 25 percent of coal used in cement manufacturing with alternate sources can reduce direct emissions by 182 kg-CO2/t-product. The estimated investment costs for waste-derived fuels range from US$1.1 per tonne of annual clinker production capacity for arranging a storage and processing facility.[21]

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[17] Technology Executive Committee. (2024, November). *Integrating hard-to-abate industries in the process of preparing and implementing nationally determined contributions* (TEC Brief No. 19). United Nations Framework Convention on Climate Change. https://unfccc.int/ttclear/misc_/StaticFiles/gnwoerk_static/TEC_documents/bb257f9ab28c416cbf76e6a75ba82875/e3dbe77ca6594d9c942eaac82320e693.pdf

[18] https://www.thenews.com.pk/latest/1352914-let-s-rewire-the-grid

[19] International Renewable Energy Agency. (2024). *Decarbonising hard-to-abate sectors with renewables: Perspectives for the G7*. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2024/Apr/IRENA_G7_Decarbonising_hard_to_abate_sectors_2024.pdf

[20] World Bank. (2025, June 25). *Cement Sector: Energy Efficiency and Decarbonization — Pakistan Sustainable Energy Series* [Report]. https://documents1.worldbank.org/curated/en/099062425092513528/pdf/P507230-f0f4130d-c6d4-4079-b1d6-2a34f7b3f936.pdf

[21] Ibid.

Nearly 40 percent of energy related emissions from cement plants can be avoided if the kiln heat is produced with green hydrogen (from renewable sources) or by using an electric kiln (using renewable electricity). The Roto Dynamic Heater (RDH) is the only electric kiln technology that can reach up to 1700°C with green electricity. It has the potential to reduce current fossil fuel-related industrial emissions by 30 percent (equivalent to a 7 percent reduction in overall global emissions).

1.3: Ensuring universal access to energy

Global & COP30 Context

The proportion of the global population with access to electricity increased from 78 percent in 2000 to 91 percent in 2021.[22] Progress towards achieving universal access to electricity (SDG indicator 7.1.1) has been slow over the last 20 years. The share of the global population with access to electricity increased from 78 percent in 2000 to 91 percent in 2021. Based on current trends, this figure is expected to rise only marginally from 91 percent in 2021 to 92 percent by 2030.[23]

South Asia drove most of the gains in the last two decades, rising from 58 percent in 2000 to 99 percent in 2021.[24] Energy access strategies often involve "leapfrogging" to off-grid solutions driven by efficiency and renewables, and may entail new business models that allow for greater access at lower costs.[25] There are many benefits to achieving energy for all. Women will save one hour per day when they do not need to collect fuelwood, freeing up the equivalent of a workforce of 80 million people, while reduced household air pollution will prevent 1.8 million premature deaths per year.[26]

Pakistan's Progress & Challenges

Pakistan has made substantial progress toward ensuring universal access to energy, with national electrification rates now exceeding 97 per cent—covering both grid and off-grid connections.[27] Rural and urban access levels are now nearly equal, reflecting steady investment and targeted policies to bridge the energy divide.[28] The government's National Action Plan for Sustainable Energy for All has provided a framework to expand electricity access, enhance energy efficiency, and integrate renewable sources into the supply mix[29]. These initiatives have helped Pakistan move closer to achieving Sustainable Development Goal 7, ensuring affordable, reliable, and modern energy for its population.

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[22] United Nations Statistics Division. (2024). *Global indicator framework after 2024 refinement (English)* [PDF]. https://unstats.un.org/sdgs/indicators/Global-Indicator-Framework-after-2024-refinement-English.pdf

[23] World Bank. (n.d.). *Goal 7: Affordable & clean energy* [SDG Atlas]. https://datatopics.worldbank.org/sdgatlas/goal-7-affordable-and-clean-energy/?lang=en

[24] Ibid.

[25] International Energy Agency. (n.d.). Recommendation 5 – Recommendations of the Global Commission on People-Centred Clean Energy Transitions. https://www.iea.org/reports/recommendations-of-the-global-commission-on-people-centred-clean-energy-transitions/recommendation-5

[26] Ibid.

[27] The World Bank Group. (2022, November). *Pakistan country climate and development report* [Report]. The World Bank. https://documents1.worldbank.org/curated/en/099950111072234047/pdf/P17671804998b80030ac4f0233dc0b995ba.pdf

[28] Ibid.

[29] United Nations Development Programme (Pakistan). (n.d.). *National Action Plan: Sustainable Energy for All* [Policy document]. UNDP Pakistan. https://www.undp.org/pakistan/publications/national-action-plan-sustainable-energy-all

Despite this progress, significant challenges remain in achieving equitable and sustainable energy access. Many households, particularly in rural regions, experience frequent outages, low voltage, and limited daily supply, undermining both productivity and quality of life.[30] Energy affordability is another critical concern, as rising tariffs and inconsistent billing structures place a heavy burden on low-income users.[31] Access to clean cooking energy remains limited, with millions still dependent on firewood and biomass, particularly in remote areas.[32] Geographic and institutional disparities—especially in provinces like Balochistan and Sindh—continue to hinder full inclusion, while financing and policy coordination challenges slow the expansion of renewable and off-grid solutions.[33] Strengthening institutional capacity, improving service quality, and accelerating the shift toward clean and affordable energy sources will be key to ensuring universal, reliable, and sustainable access for all Pakistanis.

Recommendations

Mountainous topography and scattered settlements make rural electrification costly in KP. Developing micro-hydro and solar mini-grids through community ownership models is the most viable solution for reliable and affordable access.

Rural Sindh, especially Thar and interior districts, continues to face low electrification rates despite nearby generation assets. Solar mini-grids and household-level solar systems can close access gaps and complement ongoing clean-cooking initiatives.

Balochistan's grid coverage remains the lowest among provinces. An integrated approach involving grid expansion, mini-grids, and stand-alone solar systems can be utilized to achieve electrification of remote regions guided by a geospatial least-cost plan.

Punjab's high population density allows efficient grid expansion, but peri-urban and agricultural communities still face reliability issues. Integrating decentralized solar and energy-efficiency measures would help achieve near-universal access while easing grid pressure.

Design inclusive, gender-responsive energy-access programmes. Provide targeted subsidies and micro-finance for women-led households and training for women in the renewable-energy workforce, ensuring

[30] The World Bank Group. (2022, November). *Pakistan country climate and development report* [Report]. The World Bank. https://documents1.worldbank.org/curated/en/099950111072234047/pdf/P176718049 98b80030ac4f0233dc0b995ba.pdf

[31] Memon, S. H., & Qayum, S. (2025, August 25). Energy poverty — a crisis of access, not supply. Dawn. https://www.dawn.com/news/1936957

[32] The World Bank Group. (2022, November). *Pakistan country climate and development report* [Report]. The World Bank. https://documents1.worldbank.org/curated/en/099950111072234047/pdf/P176718049 98b80030ac4f0233dc0b995ba.pdf

[33] Riaz, M. N., & Perdhana, M. S. (2024). *Challenges in implementing renewable energy initiatives in Pakistan. World Journal of Advanced Research and Reviews, 24*(1), 581–584. https://doi.org/10.30574/wjarr.2024.24.1.3042

equitable benefits from electrification. This involves designing energy projects that are gender-responsive and promote women's empowerment; ensuring that energy services are affordable and accessible to low-income households; and, providing training and employment opportunities for women in the energy sector.[34]

Mobilise capital through enhanced energy- and climate-finance mechanisms i.e. deploy green bonds, sovereign sustainability-linked instruments, and MDB co-lending for access projects. Public–private investment platforms can pool risk and attract international capital for mini-grids, clean-cooking and distributed renewables.

Align industrial and climate policies to generate decent jobs in renewables, energy services, and smart technologies, while addressing economic diversification, especially in fossil fuel-producing regions. Prioritise retraining and upskilling programs with proper funding and collaboration with educational institutions to mitigate local job losses during the transition.

Develop regional microgrids in agricultural and industrial zones integrating solar, battery storage, and EV charging. These localized systems can enhance reliability, reduce losses, and absorb excess generation capacity into productive use.[35]

[34] Sustainability Directory. (2025, March 2). *How can we ensure universal access to energy?* https://energy.sustainability-directory.com/question/how-can-we-ensure-universal-access-to-energy/

[35] https://www.thenews.com.pk/latest/1352914-let-s-rewire-the-grid

1.4: Transitioning away from fossil fuels, in a just, orderly and equitable manner

Global & COP30 context

Achieving net zero carbon emissions by 2050 will require reducing fossil fuels from 80 per cent to just 16 per cent of the global energy mix, according to the IEA's Net Zero Scenario. This means a radical phase-down of coal, gas and oil use and production over the next two and a half decades.[36] Ember's Global Electricity Review showed that clean electricity growth – led by solar and wind – has helped to slow the growth in fossil fuels in the power sector by almost two-thirds in the last ten years. Coal in particular is declining fast in the richest countries. This year, the UK – the birthplace of the Industrial Revolution – closed its last coal power plant.[37]And it's not just the UK: a third of the world's richest nations are now coal-free. Coal consumption across OECD nations has halved since its peak in 2008. Almost all OECD countries are making good progress on phasing out coal power, replacing it predominantly with solar and wind. Three-quarters of OECD countries plan to be coal-free by 2030.[38]

Pakistan's progress & challenges

Pakistan's *NDC 3.0* reaffirms a complete ban on imported coal as part of its low-carbon development strategy.[39] Coal still accounts for roughly 15–18 per cent of electricity generation, primarily from domestic Thar lignite. However, new coal investment is already slowing, with most projects either shelved or transitioning toward cleaner fuels. Gas remains a major bridge fuel, but rising LNG costs and import dependency pose fiscal and energy-security risks. The *National Adaptation Plan (2023)* identifies fossil fuel phase-down as both a mitigation and socio-economic challenge—especially for coal-dependent regions like Tharparkar—where alternative livelihoods, retraining, and just-transition planning remain nascent. Pakistan currently lacks a comprehensive *Just Transition Framework* to manage workforce displacement or repurpose fossil infrastructure. Without targeted fiscal and institutional measures, the transition risks deepening regional inequalities.

Moreover, Pakistan commenced coal-based power generation in 2017; however, its share has witnessed a consistent decline in recent years. Generation from imported coal has decreased by (41 per cent)

[36] Walker, B., & Pastukhova, M. (2024, October 14). *An orderly and equitable global transition away from fossil fuels: An action framework to navigate economic, financial and geopolitical volatility* [Briefing]. E3G. https://www.e3g.org/publications/an-orderly-and-equitable-global-transition-away-from-fossil-fuels/

[37] Jones, D. (2024, November 20). *Progress since COP28 on transitioning away from fossil fuels* [Insight report]. Ember. https://ember-energy.org/latest-insights/progress-since-cop28-on-transitioning-away-from-fossil-fuels/

[38] Ibid.

[39] Government of Pakistan. (2025, September 24). Pakistan NDC 3.0. United Nations Framework Convention on Climate Change. Retrieved from https://unfccc.int/sites/default/files/2025-09/Pakistan_NDC3.0_24 per cent20Sep.pdf

between 2021 and 2025. According to NEPRA's State of Industry Report 2024, coal contributes 17 per cent of installed power generation capacity in the National Grid (11 per cent imported coal and 6 per cent local coal) and around 16 per cent of annual electricity generation (4 per cent imported coal and 12 per cent local coal). Rapid off-grid solar adoption is significantly reducing fossil fuel reliance and accelerating Pakistan's progress toward its NDC targets30 . This reflects strong momentum in decentralized renewable solutions, supported by policy incentives and the need to ease grid dependence. Moreover, Pakistan has formulated a National Energy Efficiency and Conservation Policy-2023, targeting an emission reduction of 35 $MtCO_2e$ by 2030 through improved industrial processes, deployment of efficient appliances, and strengthened demand-side management31 .

Recommendations

KP's energy mix already includes a large share of hydropower, but its industrial zones and transport sector still rely on fossil fuels.[40] Gradual electrification of transport and incentives for cleaner industrial fuels can ensure an equitable transition without major employment shocks.

Sindh remains Pakistan's most fossil-dependent province due to its coal and gas production and the concentration of refineries near Karachi. Phasing out imported coal and accelerating electric-mobility infrastructure can align provincial energy with national decarbonization targets.

Balochistan's small thermal-generation units are inefficient and depend on imported fuels, yet the province holds strong renewable potential for replacement. Improving generation efficiency while gradually substituting fossil capacity with solar and wind will enable a balanced, just transition.

Punjab's electricity grid is dominated by fossil-fuel generation concentrated in the central corridor between Lahore and Multan.[41] Introducing carbon-capture-ready upgrades and gradually replacing older plants with renewable capacity will help the province meet national emission-reduction goals.

Clean energy transitions can create far more jobs than are lost, but new roles often demand different skills. Align industrial and climate policies to generate employment in renewable energy, grid services, and digital energy technologies while supporting economic diversification for fossil fuel-producing regions.[42] Establish a Just Transition Fund and vocational partnerships with technical institutes to reskill

[40] PEDO. (2021). *KP Power Sector Business Plan* https://pedokp.gov.pk/wp-content/uploads/2024/04/KP_Power_Sector_Business_Plan.pdf

[41] Government of Punjab. (2024). *Climate Resilient Punjab: Vision & Action Plan 2024*. https://ndrmf.pk/wp-content/uploads/2024/08/Punjab_Climate_Change_Policy_Action_Plan__1723738609_compressed.pdf

[42] https://www.iea.org/reports/recommendations-of-the-global-commission-on-people-centred-clean-energy-transitions/recommendation-1

coal and fossil-fuel workers for renewable, construction, and maintenance jobs, ensuring inclusion of youth and women.

Integrate inclusive, data-driven transition planning at national and provincial levels.National energy planning should include localized socio-economic data that captures community energy behaviours and needs. Using digital inclusion tools can prevent inequities and align local transition measures with national decarbonization goals.[43]

[43] https://www.undp.org/blog/six-ways-achieve-sustainable-energy-all

Forests, Oceans & Biodiversity

2.1: Investments to halt and reverse deforestation and forest degradation

Global & COP30 context

Since 1990, the world has lost an estimated 420 million hectares of forest through conversion to other land uses, though the annual rate of loss has declined from 16 million hectares in the 1990s to 10 million per year between 2015–2020 (FAO). The area of primary forest has still decreased by over 80 million hectares since 1990. The COP29 decision on the New Collective Quantified Goal (NCQG) on climate finance reaffirmed that halting deforestation must be a central element of post-2025 finance commitments. Debt-driven extractivism in developing economies remains a major underlying cause of deforestation. The COP30 Action Agenda urges prioritization of non–carbon-market-based finance and nature-positive investment through the Green Climate Fund (GCF) and multilateral reforms. The UNFCCC Standing Committee on Finance (SCF) is expected to advance this agenda, including through an SCF Forum on Forest Finance in 2027 to inform the first Biennial Report under the NCQG (Greenpeace).

Pakistan's progress & challenges

Pakistan retains only around 5 per cent forest cover, the lowest in South Asia, and forest area has shrunk by 18 per cent over the last 33 years—from 3.78 million hectares in 1992 to 3.09 million hectares in 2025. An estimated 27,000 hectares are lost annually to illegal logging and weak enforcement. Timber mafias, unregulated grazing, and encroachment have degraded major watersheds in Swat, Chitral, and Khyber Pakhtunkhwa, where up to 40 per cent of forest cover is already gone and could reach 70 per cent if unchecked. This ecological loss amplifies flood and landslide risk, undermining adaptation efforts. At the same time, the Delta Blue Carbon (DBC) project in Sindh—a public-private partnership between the Government of Sindh and Indus Delta Capital, demonstrates success: it covers over 350,000 hectares of mangroves, has generated USD 40 million in carbon credit sales, and positions Pakistan among the world's top seven mangrove nations, expected to rise to 4th–5th place due to aggressive reforestation. However, large-scale forest restoration and community-based protection remain underfunded relative to the scale of degradation.

Recommendations

KP should prioritise restoring degraded mountain forests and protecting watersheds through

community forestry models that ensure local stewardship and long-term forest health.[44] The province's extensive natural forest cover and proven reforestation record make it a key zone for large-scale investment in forest restoration and watershed resilience.[45]

Sindh should direct new investments towards protecting and regenerating its Indus River forests and promoting agroforestry in eroding floodplains. Riverine and wetland forests are among the province's most critical ecosystems for flood control, biodiversity, and local livelihoods.[4647] Balochistan should scale up afforestation and rangeland rehabilitation in upland catchments using native species and drought-tolerant shelterbelts to halt ongoing land degradation. These measures would stabilise soils, prevent desertification, and enhance water retention across the province's arid landscapes.[48]

Punjab should expand investments in riparian and agroforestry plantations, especially in southern and central districts where tree cover remains low. Converting degraded riverbanks and marginal farmland into managed forest corridors would enhance carbon storage and protect against floods and soil erosion.[49]

Restore forest cover to prevent worsening floods and ecosystem collapse. There is a direct correlation between declining forest cover and worsening flood impacts, with the alarming depletion of forest reserves in Khyber Pakhtunkhwa pushing the province's fragile ecosystem to the brink of collapse. Urgent reforestation and watershed restoration are needed to stabilise soils, regulate water flow, and reduce future flood damage.[50]

Crack down on timber mafias to protect Pakistan's forests. In Swat, 30–40 per cent of forests are already gone, with losses projected to reach 70 per cent if unchecked. In Chitral's Rumbur Valley alone, 700,000 trees were felled under the guise of being "unhealthy," while 8.8 million cubic feet of timber was

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[44] https://epakp.gov.pk/wp-content/uploads/2022/09/Khyber-Pakhtunkhwa-Climate-Change-Policy-2022.pdf
[45] documents.worldbank.org/en/publication/documents-reports/documentdetail/099925305272421694/pdf/IDU165ef391614bdc141121b3921d9e7a580827e.pdf
[46] https://transparency.org.pk/Climate-change-Policies/Sindh-Climate-Change-Policy-2022-(Final).pdf
[47] https://www.cbd.int/doc/world/pk/pk-nbsap-v2-en.pdf
[48] https://www.undp.org/sites/g/files/zskgke326/files/2024-11/bccp_report.pdf
[49] https://epd.punjab.gov.pk/system/files/Climate%20Resilient%20Punjab%20Vision%20&%20Action%20Plan%202024.pdf
[50] https://www.app.com.pk/national/national-dialogue-urges-legal-policy-governance-reforms-to-protect-depleting-green-cover-in-kp/

officially marked for cutting.[51] Without decisive action on enforcement, community-led forest management, and curbs on illicit logging, Pakistan will remain dangerously exposed to every extreme weather event.

[51] https://www.dawn.com/news/1647355

2.2. Efforts to conserve, protect, and restore nature and ecosystems with solutions for climate, biodiversity and desertification

Global & COP30 context

Worldwide, droughts cause over 15 per cent of all disaster-related damages and losses, amounting to US $124 billion in economic losses from 1998 to 2017.[52] Up to 40 per cent of global land is degraded, affecting 3.2 billion people and exacerbating food insecurity, poverty, and conflict over natural resources.[53] Land degradation and desertification (DLDD) cost the global economy US $878 billion annually, while restoring the one-billion-hectare area pledged under global agreements could yield US $1.8 trillion per year in returns, with an internal rate of return between 7–30 times the investment.[54] Closing this restoration-finance gap requires roughly US $2.6 trillion by 2030, only a fraction of the cost of inaction.[55]

Infrastructure expansion, worth US $2.5 trillion annually, remains a key driver of biodiversity loss; aligning infrastructure-finance safeguards with IUCN biodiversity mitigation principles is critical for achieving COP30's "nature-positive" action agenda.[56]

Pakistan's progress & challenges

Pakistan is among the most land-degraded and drought-prone countries globally. Of its 79.6 million hectares, around 62 million hectares are vulnerable to desertification, particularly in Sindh, Balochistan, and South Punjab[57]. Recurrent droughts, deforestation, and overgrazing have led to vegetation loss, soil erosion, and desert expansion, heightening food and water insecurity. The *Living Indus Initiative*—Pakistan's flagship ecosystem restoration programme supported by the UN—identifies 25 interventions across the Indus Basin, covering wetland and delta ecosystems, forest regeneration, and rangeland rehabilitation. Pakistan's *National Adaptation Plan (NAP)* and *NDC 3.0* both prioritise ecosystem restoration, but highlight the urgent need for sustainable financing, institutional coherence, and integration of nature-based solutions into development policy.

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[52] https://iucn.org/blog/202506/nature-based-solutions-worlds-drylands-why-iucns-leadership-matters-desertification
[53] https://iucn.org/blog/202506/nature-based-solutions-worlds-drylands-why-iucns-leadership-matters-desertification
[54] Ibid.
[55] Ibid.
[56] https://conbio.onlinelibrary.wiley.com/doi/full/10.1111/cobi.14095#:~:text=Of%20the%20155%20banks%2C%2042,conditions%20for%20effective%20biodiversity%20offsetting.
[57] https://www.brecorder.com/news/40194248

Recommendations

KP should integrate biodiversity protection into its watershed management and reforestation programs to secure ecosystem services for downstream communities. Strengthening protected-area networks and expanding ecosystem-based adaptation in mountain ecosystems would reinforce resilience to floods and landslides.[58].

Sindh should prioritise restoring wetland, desert, and mangrove ecosystems through community-based management and blue-carbon investments. Expanding mangrove and grassland regeneration in Thar and the Indus Delta would deliver simultaneous climate, biodiversity, and livelihood benefits.[59]

Balochistan should invest in restoring degraded rangelands and stabilising sand dunes to counter desertification and secure grazing livelihoods. These landscape-scale interventions can reduce dust storms, enhance soil fertility, and support pastoral communities' climate resilience.[60]

Punjab should restore riverine wetlands and promote biodiversity-friendly farming systems through incentives for hedgerows, field margins, and agroecological corridors. These measures would strengthen ecosystem connectivity and safeguard biodiversity in intensively cultivated landscapes.[61]

Pakistan should adopt a landscape-scale approach to conservation and ecosystem restoration, integrating biodiversity protection with climate adaptation and sustainable livelihoods. Strengthening protected-area management, restoring degraded rangelands and wetlands, and promoting ecosystem-based adaptation in forests, deserts, and river basins would help reverse land degradation, enhance carbon sequestration, and build community resilience to climate shocks.

Most policies that address biodiversity are fragmented and target specific. Additionally, the current design of governance, institutions and policies rarely takes into account the diverse values of biodiversity. There are also substantial challenges to the design and implementation of effective transboundary and regional initiatives to halt biodiversity loss, ecosystem degradation, climate change and unsustainable development. Another key challenge to successful policy-making is adequate mobilization of financial

[58] https://epakp.gov.pk/wp-content/uploads/2022/09/Khyber-Pakhtunkhwa-Climate-Change-Policy-2022.pdf
[59] https://transparency.org.pk/Climate-change-Policies/Sindh-Climate-Change-Policy-2022-(Final).pdf
[60] https://www.undp.org/sites/g/files/zskgke326/files/2024-11/bccp_report.pdf?utm_source=chatgpt.com
[61] https://epd.punjab.gov.pk/system/files/Climate%20Resilient%20Punjab%20Vision%20&%20Action%20Plan%202024.pdf

resources. Increased funding from both public and private sources, together with innovative financing mechanisms such as ecological fiscal transfers, would help to strengthen institutional capacities.[62]

[62] https://www.unesco.org/en/biodiversity/conservation

2.3. Efforts to preserve and restore oceans and coastal ecosystems

Global & COP30 context

The ocean covers 70 per cent of Earth's surface, holds 97 per cent of all water, and supports 80 per cent of life forms.[63] The global "blue economy," spanning tourism, fisheries, shipping, aquaculture, and marine renewables, was valued at US $1.5 trillion in 2010 and is projected to double to US $3 trillion by 2030.[64] Yet ocean health is deteriorating rapidly: 2024 marked the highest ocean heat content in the 65-year observational record, with each of the past eight years setting new highs. Sea levels have risen at twice the rate of the 1990s.[65] The COP30 Action Agenda emphasizes embedding oceans in NDCs and national climate plans, enhancing blue carbon ecosystems (mangroves, seagrasses, salt marshes), and mobilising finance for coastal resilience. Financial institutions, through lending, underwriting, and investment, are key to mainstreaming the sustainable transformation of ocean-linked industries.[66] Innovative measures, like Seychelles' "blue barriers" combining coral restoration and reef-based coastal defence, demonstrate scalable hybrid solutions offering both biodiversity and economic co-benefits.[67]

Pakistan's progress & challenges

Pakistan has made notable progress in preserving and restoring its oceans and coastal ecosystems, particularly through large-scale mangrove restoration and marine conservation initiatives. National mangrove cover has expanded significantly over the past three decades, mainly due to reforestation projects and community-led conservation efforts along the Indus Delta and Makran coasts. The Delta Blue Carbon Project in Sindh, covering more than 350,000 hectares, stands out as one of the world's largest mangrove restoration and carbon sequestration initiatives, generating over $40 million in verified carbon credits while supporting local livelihoods.[68] In Balochistan, restoration efforts such as those in the Sonmiani Marsh region have successfully rehabilitated degraded coastal areas using sustainable ecological practices.[69]

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[63] https://www.unepfi.org/themes/ecosystems/bluefinanceguide
[64] Ibid.
[65] https://wmo.int/sites/default/files/2025-03/WMO-1368-2024_en.pdf#:~:text=KEY%20MESSAGES%20%E2%80%A2%20The%20annually,ten%20years%2C%202015%E2%80%932024%2C%20were%20individually
[66] https://www.unepfi.org/themes/ecosystems/bluefinanceguide/
[67] https://blogs.worldbank.org/en/climatechange/blue-barriers-nature-based-solution-build-resilience?
[68] https://www.dawn.com/news/1926851
[69] https://www.nation.com.pk/15-Mar-2023/16-acres-of-mangrove-forest-successfully-restored-in-balochistan

Despite this progress, major challenges persist in achieving sustainable marine and coastal conservation. Pollution from plastics, sewage, and industrial waste, coupled with overfishing and unregulated coastal development, continues to degrade marine habitats.[70] Weak enforcement of environmental regulations and insufficient funding for marine protected areas limit the effectiveness of conservation policies.[71]

Recommendations

Sindh should expand mangrove protection and restoration in the Indus Delta, particularly in Keti Bunder and Kharo Chan, to enhance coastal resilience and fisheries productivity. Strengthening legal protection and restoring freshwater flows would help reverse long-term degradation of deltaic ecosystems.[72]

Balochistan should establish protected coastal zones around Jiwani, Kalmat, and Gwadar and support community-led mangrove and seagrass restoration. These interventions would enhance biodiversity, buffer storm impacts, and sustain small-scale fisheries along the Makran coast.[73]

Punjab should prioritise upper-catchment conservation and riparian restoration to improve sediment and water flows reaching the Indus Delta. Protecting soil and water resources upstream will directly support coastal ecosystem recovery downstream in Sindh.[74]

KP should strengthen upstream watershed management to reduce sedimentation and maintain healthy river flows that sustain coastal ecosystems. Improved forest and soil management in the highlands would help reduce flood damage and protect biodiversity downstream.[75]

Recognize the role of marine and coastal ecosystems as vital global carbon sinks. Develop adequate carbon management and possibly offset schemes for marine and coastal ecosystems. Enhance long-term monitoring of carbon in the ocean and support efforts to quantify the ocean's role in the global carbon cycle.[76]

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[70] https://www.dawn.com/news/1901354/pakistan-reaffirms-commitment-to-climate-resilient-initiatives-to-protect-coastal-ecosystems

[71] https://www.dawn.com/news/1857830/sindh-balochistan-govts-urged-to-step-up-efforts-to-conserve-marine-ecosystems

[72] https://transparency.org.pk/Climate-change-Policies/Sindh-Climate-Change-Policy-2022-(Final).pdf

[73] https://www.undp.org/sites/g/files/zskgke326/files/2024-11/bccp_report.pdf

[74] https://epd.punjab.gov.pk/system/files/Climate%20Resilient%20Punjab%20Vision%20&%20Action%20Plan%202024.pdf

[75] https://epakp.gov.pk/wp-content/uploads/2022/09/Khyber-Pakhtunkhwa-Climate-Change-Policy-2022.pd

[76] https://iucn.org/sites/default/files/import/downloads/the_ocean_and_climate_change_executive_summarypdf

Expand Marine Protected Areas (MPAs). Pakistan has designated two main Marine Protected Areas (MPAs): Astola Island, Pakistan's first MPA established in June 2017, and Churna Island, designated as the second MPA in September 2024. Astola Island, located off the coast of Balochistan, is an important site for coral, birds, and sea turtles.[77]

[77] https://news.mongabay.com/2025/07/with-coral-rich-churna-island-now-an-mpa-pakistan-takes-baby-steps-on-ocean-protection/

Agriculture & Food Systems

3.1 Land restoration and sustainable agriculture

Global and COP30 Context

At COP28, it was agreed that efforts to conserve natural ecosystems, a commitment carried into COP30's Action Agenda on Agriculture and Food Systems. This ambition carries through as a staple to COP30's Action Agenda on Agriculture and Food Systems. Agriculture produces 95 per cent of the world's food, yet roughly 40 per cent of the world's land is degraded, 20 per cent due to human activity.[78] In 2024, extreme weather caused the highest climate-related displacements since 2008, triggering food crises in 18 countries.

To meet global goals, 1.5 billion hectares must be restored by 2030; 1 billion hectares have been pledged through initiatives such as the G20 Global Land Restoration Initiative and the Great Green Wall Initiative.[79][80] Climate change has already reduced agricultural productivity by 21 per cent since 1961, while nearly a quarter of land is degraded from deforestation, unsustainable farming, and urbanisation. COP30 calls for a shift to regenerative, climate smart agriculture to build resilient food systems aligned with the Paris Agreement and the Kunming-Montreal Global Biodiversity Framework.[81]

Pakistan's Progress and Challenges

Agriculture remains Pakistan's economic backbone, contributing around 24 per cent of the GDP, and employing almost 40 per cent of the national labour force.[82] However, the sector is acutely vulnerable to climate shocks: the 2025 floods alone, inundated about 1.3 million acres of crops across Punjab and Sindh, destroying up to 80 per cent of Bahawalnagar's cotton crop and causing nationwide losses exceeding PKR 500 billion.

Pakistan's updated NDCs prioritise climate-smart agriculture (CSA), sustainable land management, and improved water efficiency. National and provincial policies emphasise soil health, afforestation, and resilient cropping systems, with programmes like the Upscale Green Pakistan Programme (UGPP) under implementation.[83] The Delta Blue Cabon Project in Sindh, launched in 2015, has restored

[78] Food and Agriculture Organization of the United Nations. (2025). *About RAIZ*. FAO. https://www.fao.org/climate-change/fao-at-cop30/raiz/about-raiz/en

[79] https://www.unccd.int/our-work/flagship-initiatives/G20-Initiative

[80] https://www.unccd.int/our-work/ggwi

[81] https://www.unep.org/resources/kunming-montreal-global-biodiversity-framework

[82] https://unfccc.int/sites/default/files/2025-09/Pakistan_NDC3.0_24 per cent20Sep.pdf

[83] https://unfccc.int/sites/default/files/2025-09/Pakistan_NDC3.0_24%20Sep.pdf

350,000 hectares of Mangroves, and generated $40 million through carbon credit sales. Pakistan now ranks seventh globally in mangrove area, with reforestation efforts expected to push it higher.[84]

Recommendations

Integrate land management reforms into agricultural and water planning. Discontinue cultivation in fragile floodplains, promote agroforestry in canal command areas, and link crop insurance to climate-positive practices. With over 44 million livestock dependent on rangelands, SLM must be central to rural policy.

Scale climate-smart agriculture through finance and technology. Agriculture drives one-third of global GHG emissions but receives just 4 per cent of climate finance, most of which bypasses smallholders. Align domestic and international funding with CSA priorities, enabling precision irrigation, digital tools, and resilient seed adoption across Pakistan's agrifood systems.

Flood resilience depends on how land is cultivated. Promote sustainable land management that integrates soil conservation, regenerative farming, and water harvesting. Local successes, from Tharparkar, Sindh's revival of Beris improving water access by 60 per cent across 15 villages to reforestation in Gilgit Baltistan reducing soil erosion by 25 per cent, show scalable models for resilience.

Integrating climate change considerations into the 2019 Mines and Minerals Policy to protect fragile ecosystems is crucial, especially in Balochistan. Sustainable mining that uses low-impact technologies and ensures local community participation needs to be prioritised, linking mineral development to environmental safeguards and livelihood resilience.

With 80 per cent of the population in Khyber Pakhtunkhwa dependent on agriculture, and livestock contributing 52 per cent to the sector, in resilience must centre on land and forest restoration. Conduct baseline studies to assess resource management capacity across forest species, wetlands and agro-ecological zones, and expand farmer training on soil and water conservation.

Successful agroecological initiatives in southern Punjab already show 20–35 per cent income gains and healthier soils. Promoting climate-smart agriculture, including crop diversification, efficient irrigation, and reduced chemical use, can boost productivity and resilience. Punjab's resilience depends on restoring and upgrading irrigation systems to reduce flood and water losses.

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[84] Profit. (2025, July 26). *Pakistan's mangrove forests generate millions in carbon credits, offer $50 million annual potential: Minister.* Profit by Pakistan Today. https://profit.pakistantoday.com.pk/2025/07/26/pakistans-mangrove-forests-generate-millions-in-carbon-credits-offer-50m-annual-potential-minister/

3.2. More resilient, adaptive, and sustainable food systems

Global and COP30 Context

Food systems worldwide are increasingly exposed to shocks, from climate extremes to conflict and economic stress, threatening food and nutrition security for billions. In 2022, between 691 and 783 million people faced hunger, and projections suggest persistent challenges through 2030. The global food system currently generates an estimated US$12 trillion in hidden social, economic, and environmental costs annually, and in its present form, cannot sustainably provide healthy diets for a projected 9.7 billion people by 2050 without escalating emissions and natural resource loss.

Agriculture and food systems are a leading source of greenhouse gas emissions, particularly methane, and are responsible for biodiversity loss and heavy freshwater consumption (approximately 70 per cent). Food waste alone would rank as the third-largest emitter globally. Without decisive climate mitigation in the agri-food sector, the goals of the Paris Agreement are at risk. COP30 emphasizes building resilient, adaptive, and sustainable food systems that reduce emissions, protect ecosystems, and strengthen global food security.

Pakistan's Progress and Challenges

Pakistan's food systems are highly vulnerable to climate and economic shocks. The 2025 floods caused estimated economic losses of PKR 562 billion (USD 2 billion), with agriculture absorbing the heaviest impact at PKR 476 billion (USD 1.6 billion). Key crops and livestock were severely affected, contributing to projected GDP growth for FY26 dropping to 3.2 per cent and agriculture growth slashed from 2.2 per cent to 1.1 per cent. Domestic food price inflation is also expected to rise to 7.2 per cent, reflecting shortages in staples such as meat, rice, vegetables, and sugar.

While Pakistan has introduced climate-smart agriculture policies and CSA practices through its NDC commitments and National Climate Change Policy, structural challenges remain. Inefficient irrigation, poor water governance, and limited access to finance for smallholders constrain resilience and adaptation.

Recommendations

Punjab: Prioritise rapid rehabilitation of smallholder and peri-urban supply chains by ring-fencing emergency climate finance for crop re-establishment, seed and fodder distribution, and conditional cash for labour-intensive land restoration (to avoid distress sales and forced livelihood exits). Pair emergency

support with medium-term investment in flood-resilient sowing calendars, elevated seed banks, and compact irrigation upgrades that reduce post-flood crop losses and protect rabi sowing windows.

Sindh: Scale mangrove and wetland restoration plus community-run floodplain agroecology pilots to rebuild fisheries and rice systems damaged in 2025, using nature-based solutions that store carbon and mitigate future inundation. Fast-track a Sindh resilience fund (grants + results-based payments) that rewards farmers for adopting water-efficient cropping (pulses, oilseeds), seasonal migration of high-risk crops, and on-farm post-harvest storage to cut losses after extreme events. Ensure any rice rehabilitation programme incorporates alternate wetting/drying and incentivised methane mitigation to reduce agricultural emissions.

Khyber Pakhtunkhwa (KPK): Invest in hill-slope soil restoration, terracing and community seed networks so upland systems recover faster from flash floods and landslides. Provide mobile veterinary and fodder support for transhumant and pastoral households affected in 2025, and integrate early-warning to planting/market signals so smallholders can shift cropping and livestock timing ahead of extreme events. Strengthen local agri-extension on climate-resilient crop varieties and support village-level grain/fodder stores to prevent distress sales.

Balochistan: Prioritise drought-to-flood resilience by financing rainwater harvesting, zai-style micro-catchments and fodder banks that buffer pastoralists against greater variability revealed in 2025. Introduce tailored insurance or social protection top-ups for remote livestock holders and scale community-managed rangeland restoration to secure carbon and pastoral livelihoods. Link mineral-sector planning to strict erosion controls and post-mine land rehabilitation (to avoid compounding food and water insecurity).

Make climate-smart agriculture a conditionality for any large post-flood reconstruction finance: redirect fertilizer subsidies toward soil health and drought/flood-tolerant seed programmes, scale extension for regenerative practices, and create an inclusive public procurement pathway (school feeding, public hospitals) that buys climate-friendly produce from smallholders. Use true-cost accounting to target investments—global analysis shows the food system's hidden costs are enormous, and Pakistan's 2025 floods underline that resilience investments now avert far greater social and economic losses later

3.3. Equitable access to adequate food and nutrition for all

Global and COP30 Context

Food and nutrition insecurity remains a persistent global challenge. In 2020, 155 million people faced acute food insecurity, rising to an estimated 272 million in 2021, with 41 million people across 43 countries on the brink of famine. Beyond these figures, three billion people globally cannot afford even the cheapest form of a healthy diet, while 149 million children under five are stunted, over 49 million are wasted, and more than 40 million are overweight, increasing their risk of non-communicable diseases

Food systems are deeply inequitable, a problem that has garnered growing international attention under the 2030 Agenda and the Sustainable Development Goals. They generate an estimated US$12 trillion in hidden social, economic, and environmental costs each year (World Bank), emit one-third of global greenhouse gases, and are the leading source of freshwater use and biodiversity loss. Shocks such as conflict—as seen in Ukraine and Gaza—and extreme weather exacerbate insecurity, displace communities, and disrupt agricultural and industrial production, especially in fragile regions.

Gender inequity further compounds these challenges. Rural women produce up to 80 per cent of household food in developing countries, yet hold fewer than 15 per cent of smallholder land titles globally, and fewer than 5 per cent in sub-Saharan Africa (FAO, 2018). COP30 emphasizes the need for resilient, inclusive, and equitable food systems that address these structural inequalities while mitigating climate and environmental impacts.

Pakistan's Progress and Challenges

Pakistan faces acute vulnerabilities in its food systems, magnified by extreme weather events. The 2022 floods caused a sharp fall in rice production, contributing to global price increases and straining household budgets in rice-dependent countries (UNDP). In Sindh, rainfall reached 426 per cent above average, prompting emergency interventions such as the Sindh Flood Emergency Housing Reconstruction Project. This initiative has invested over $1.5 billion to construct 350,000 hazard-resistant homes, assigning land ownership to female heads and engaging more than 157,000 women in reconstruction, marking a significant step toward gender equity (ADB).

Despite these advances, Pakistan's food system faces ongoing challenges: high domestic food price inflation, limited access to technology and climate-smart practices, inadequate market infrastructure, and inequities in the distribution of resources among smallholders.

Recommendations

Punjab: Rapidly expand a targeted social protection + food assistance package that links immediate post-2025 flood relief (cash, fortified food, seed/fodder) to conditional, short-term employment for land restoration and irrigation repairs so households recover purchasing power without selling productive assets. Pair this with a provincial school-meals procurement policy that buys from local smallholders (preferential procurement for climate-smart producers), protecting nutrition for children while restoring demand for farmers hit by the 2025 inundations. Ensure monitoring ties relief spending to nutrition outcomes (wasting/stunting) and to COP30 commitments on food-system resilience.

Sindh: Scale community-driven maternal & child nutrition interventions (mother-and-baby friendly cash-plus packages, community health workers, therapeutic feeding) in flood-affected districts alongside investments in climate-resilient fisheries and mangrove-linked aquaculture to restore protein access and livelihoods lost in 2025. Design reconstruction grants (housing/land tenure work under the Sindh Emergency Housing Reconstruction Project) to include women's land/benefit rights and nutrition conditionalities (e.g., household latrine + child nutrition screening) so recovery advances gender equity and food access simultaneously.

Khyber Pakhtunkhwa (KPK): Prioritise mobile nutrition outreach and rapid cold-chain hubs in remote and displacement-affected areas to keep perishable nutritious foods available after climate shocks; couple this with voucher schemes for smallholder households to purchase diversified seeds and nutrient-dense inputs (pulses, oilseeds, vegetable seedlings). Strengthen linkages between emergency veterinary support (post-flood livestock losses) and household nutrition programmes so animal-source foods remain part of dietary recovery pathways.

Balochistan: Deploy shock-responsive grants for pastoralists (fodder banks, feed vouchers, cash-for-work for rangeland restoration) and scale community-managed water harvesting that secures small-scale horticulture to improve year-round access to fresh foods. Introduce mobile maternal/child nutrition clinics that reach scattered rural populations and connect entitlements to local markets so nutrition access is not lost when commodity prices spike after extreme weather.

In the heavily irrigated south where 2025 floods and water shocks intersect, finance rapid rehabilitation of market hubs and rural storage (hermetic bags, small cold rooms) to prevent post-harvest loss and stabilise prices for staples and perishable nutritious foods. Use results-based finance to incentivise farmers to shift part of cropping to pulses/legumes and diversified vegetables for local markets and school feeding, reducing vulnerability to single-crop failures and improving dietary diversity.

Integrate nutrition into all agricultural recovery and resilience investments: redirect a portion of input subsidies toward nutrient-sensitive crops and smallholder nutrition services; mainstream gendered land and benefit safeguards so women (critical for household food security) gain access to entitlements created during reconstruction; expand routine nutrition surveillance (wasting and stunting) to trigger automatic emergency nutrition scale-up. Use COP30 pledges to secure blended finance for community-level food storage, school feeding, and maternal-child nutrition so future shocks don't reverse gains.

Cities, Infrastructure & Water

4.1 Multilevel governance

Global and COP30 Context

Multilevel governance — aligning city, regional/provincial and national action — is now central to COP30's Action Agenda because urban water risks cross administrative borders (stormwater, groundwater, sewerage, and drainage) and require coordinated finance, standards and data to be operationally effective. Recent policy syntheses argue that NAPs and NDCs must be translated into "locally determined contributions" and municipal practice to close the implementation gap between high-level commitments and on-the-ground resilience.[85] Effective multilevel governance bundles four things: shared risk assessment tools and indicators; finance structures that flow to subnational implementers; formal coordination mechanisms (mandates, joint planning units, dispute-resolution); and common data/operation platforms for water allocation, early warning and service delivery.[86]

Pakistan's Progress and Challenges

Pakistan has important entry points: its 2023 National Adaptation Plan and successive NDCs explicitly call out urban water, storm-water management, and the need to mainstream adaptation into sectoral planning.[87] Several city-level initiatives (for example Karachi's Climate Action Plan and World Bank/ADB urban water investments) show how technical solutions can be packaged.[88] But persistent barriers remain: fragmented institutional mandates across municipal, provincial and federal tiers; chronic underinvestment in urban drainage and wastewater (high non-revenue water, leaky networks); weak real-time data-sharing between agencies; and finance that tends to flow to central projects rather than subnational operations. The result: rapid, expensive reactive recovery instead of lower-cost preparedness and continuous maintenance.

The 2025 floods damaged thousands of houses, bridges and urban roads and triggered multi-sectoral public-health emergencies; this is the precise failure mode multilevel governance must prevent by making roles, resources and operational plans interoperable before the next shock.[89] To convert COP30 commitments into city-level outcomes, Pakistan needs three mutually reinforcing shifts: (1) institutional clarity (who does what, and when); (2) finance re-engineering (predictable flows to subnational asset maintenance, and fast-disbursing shock funds); (3) interoperable data & operations

[85] Government of Pakistan. (2025). *Pakistan's Third Nationally Determined Contribution (NDC 3.0)*. UNFCC
[86] ibid.
[87] ibid.
[88] The Urban Unit. (2025). Karachi Climate Action Plan. UNDP.
[89] Muhammad Ehsan Leghari. (2025, September 10). Not just a disaster, the 2025 floods are a call to reimagine resilience. Dawn. https://www.dawn.com/news/1940947

(shared indicators, telemetry and risk dashboards tied to early warning and service continuity). These are technical changes but they are governance changes first, they require legal mandates, MOUs, and joint investment cases that make provincial and municipal action bankable.

Recommendations

Establish a formal Punjab City–Province Water Resilience Forum that signs binding MOUs with major municipal water utilities (Lahore, Gujranwala, Multan) for joint drainage investment planning, shared telemetry, and an 18-month pilot "urban shock window" to rapidly disburse funds and restore services after events like the 2025 floods; couple the forum with a provincial maintenance fund to prioritise conveyance & stormwater assets rather than one-off capital works.[90]

Create a Sindh Urban Resilience Board that integrates city (Karachi, Hyderabad) plans with provincial floodplain management and mangrove/nature-based drainage solutions, mandate data-sharing with Karachi Water & Sewerage and require donor/climate grants to allocate a defined share to municipal O&M and community early-warning systems to prevent the breakdowns observed in 2025.

Institutionalise county-level (district) water coordination units linked to Peshawar/Mardan municipalities and the provincial irrigation department to harmonise urban drainage, landslide risk maps and emergency response triggers; fund mobile telemetry and rapid repair teams so upstream flash-flood warnings automatically trigger downstream utility actions

Establish provincial mandates for integrated urban-rural water governance (coordinating municipal authorities, provincial irrigation and rangeland agencies) with ring-fenced finance for drainage upgrades in coastal/urban hotspots and a mobile operations fund for rapid repairs after storm surge or flash floods. Require post-mining land rehabilitation plans to be integrated into municipal drainage and watershed management

Use federal NAP/NDC instruments to mandate interoperability standards, require a fixed percentage of international adaptation finance to flow directly to provincial/municipal resilience budgets, and underwrite a national "urban resilience demonstrator" fund (one pilot per province) that couples MOUs, shared risk dashboards and measurable service-continuity KPIs so COP30 pledges quickly translate into city outcomes.

Standardise a small set of interoperable urban water KPIs (service hours, sewer overflow incidents, stormwater capacity by return period), require public dashboards and pre-agreed emergency triggers,

[90] WIRE, N. (2025, September 23). Pilot project planned for instant cash aid in disaster-hit areas. The Nation. https://www.nation.com.pk/23-Sep-2025/pilot-project-planned-instant-cash-aid-disaster-hit-areas

and condition national/donor disbursements on signed intergovernmental MOUs to fix the governance gap exposed by the 2025 floods.

Ring-fence predictable subnational adaptation finance: require a share of national climate finance and donor adaptation grants to be allocated directly to provincial/municipal resilience budgets (for drainage, wastewater upgrades, stormwater green infrastructure and operations). Include a rapid-disbursement "urban shock window" for immediate repairs after events like the 2025 floods.

Reform planning and procurement to prioritise maintenance & nature-based solutions: shift municipal capital planning away from one-off build projects to lifecycle maintenance funds; integrate nature-based drainage (bioswales, restored urban wetlands, mangrove buffers where applicable) as cost-effective complements to grey infrastructure. Procurement must allow for performance-based contracts (maintenance, not only construction).

4.2 Sustainable and Resilient Constructions and Buildings

Global and COP30 Context

Sustainable construction and resilient building design are central to COP30's urban adaptation agenda, aligning with global frameworks such as the UNEP Building Climate Resilient Urban Future report and SDG 11. Resilient construction integrates both frangible architecture, where parts of structures are designed to yield safely during floods or high winds, and nature-based solutions that combine built and ecological systems.[91] These include green roofs, bioswales, permeable pavements, retention ponds, and urban forests, all of which reduce runoff, regulate temperature, and enhance liveability.

Globally, buildings account for nearly 37 per cent of energy-related CO_2 emissions and are among the sectors most vulnerable to climate hazards.[92] COP30's emphasis on "resilient cities and infrastructure" calls for integrating adaptation, mitigation, and inclusivity in the built environment, moving from reactive reconstruction to proactive resilience that protects people and assets in high-risk zones.

Pakistan's Progress and Challenges

Pakistan's construction sector is rapidly expanding but remains largely unregulated in climate terms. Urban growth often disregards hydrological systems, natural drainage, and floodplain zoning, leading to encroachments and severe flood losses.[93] The National Adaptation Plan (NAP 2023) identifies urban infrastructure resilience as a critical gap, with limited enforcement of the Building Codes of Pakistan (Seismic and Energy Provisions) and weak institutional capacity at the local level.

Deforestation and unplanned urban expansion have intensified surface runoff and sedimentation: Pakistan lost 8 per cent of tree cover between 2001 and 2024, particularly around urban corridors, reducing infiltration and storage.[94] Despite post-flood housing initiatives, notably the Sindh Flood Emergency Housing Reconstruction Project (ADB/WB, 2023), there is no unified resilience framework guiding material standards, energy efficiency, or design adaptation to local hazards.

[91] UNEP. (n.d.). A Practical Guide to Climate-resilient Buildings & Communities. https://wedocs.unep.org/xmlui/bitstream/handle/20.500.11822/36405/Adapbuild.pdf
[92] ibid.
[93] Hasan, A. (2025, September 14). Reporting on floods. Dawn. https://www.dawn.com/news/1941853
[94] Nazar, Y. (2025, September 3). Pakistan's Paradox Of Floods And Water Shortage. The Friday Times. https://www.thefridaytimes.com/03-Sep-2025/pakistan-s-paradox-of-floods-and-water-shortage

At COP30, Pakistan's NDC revision will likely prioritise integrating building-sector resilience with mitigation, through low-carbon materials, passive cooling, and renewable integration, in alignment with CPSER 2023 recommendations for greener urban finance.

Recommendations

Amend the Punjab Building Regulations 2021 to include climate-resilient and frangible design codes for flood-prone housing along the Ravi and Sutlej corridors. Introduce sponge city pilot projects in Lahore and Multan that combine permeable roads, retention basins, and urban forests to absorb runoff and mitigate heat. Develop an urban green building fund co-financed under the Punjab Climate Change Policy 2024 to retrofit public buildings with reflective roofs and solar integration.[95]

Mainstream nature-based and blue infrastructure into the Karachi Strategic Development Plan 2040, mapping and legally protecting stormwater drains and nullahs. Expand the Sindh Flood Housing Project's resilient design standards—elevated plinths, reinforced mud walls, and ventilated floors—to urban reconstruction programs. Introduce urban mangrove buffers and shaded corridors to address both heat stress and flooding in coastal cities.[96]

Adopt a Resilient Housing Framework under the KP Urban Policy Unit requiring flood- and landslide-adapted designs using local, low-carbon materials. Enforce integration of rainwater harvesting and passive cooling systems in Peshawar, Swat, and Abbottabad's new housing schemes. Link building approvals with hazard maps developed under KP's Provincial Adaptation Action Plan.[97]

Implement water-sensitive urban design in Quetta, Gwadar, and Turbat, integrating cisterns, infiltration trenches, and shaded courtyards into building codes. Enforce sustainable brick and cement production standards to curb emissions from unregulated kilns, in line with the CPSER 2023 and NDC 2021 targets for industrial decarbonisation. Pilot cool-roof retrofits in heat-prone southern districts to reduce urban heat island effects.[98]

Update the Building Codes of Pakistan (Energy and Seismic Provisions) to include climate adaptation criteria, such as flood resistance, heat performance, and energy recovery ventilation, applicable to all federal and provincial jurisdictions. Launch a National Urban Green Infrastructure Fund to co-finance provincial stormwater and green roof projects, tracked through the NDC monitoring platform

[95] NDRMF. (2024). Punjab Climate Change Policy and Action Plan.
[96] Hasan, A. (2025, September 14). Reporting on floods. Dawn. https://www.dawn.com/news/1941853
[97] UN-HABITAT. (2024). Annual Report 2024 | UN-Habitat. Unhabitat.org. https://unhabitat.org/annual-report-2024
[98] UNFCCC. (2023). Pakistan National Adaptation Plan.

(MoCC). Establish a national certification system for resilient construction materials to standardise performance.[99]

Mandate annual urban resilience audits of building and infrastructure assets, integrate resilience into municipal approval workflows, and incentivise private developers through concessional finance and tax credits for sustainable materials. Link urban construction to the National Climate Finance Strategy to attract adaptation funding and accelerate alignment with COP30 targets.[100]

[99] UNFCCC. (2021). Pakistan Nationally Determined Contribution .

[100] UNEP. (n.d.). A Practical Guide to Climate-resilient Buildings & Communities. https://wedocs.unep.org/xmlui/bitstream/handle/20.500.11822/36405/Adapbuild.pdf

4.3 Resilient urban development, mobility, and infrastructure

Global and COP30 Context

COP 30's agenda pushes for "resilient urban development, mobility and infrastructure" because the balance between rapid urbanisation and climate risk is now critical. Urban resilience refers to the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow despite chronic stresses and acute shocks.[101] Cities are central to the global economy, generating over 80 per cent of global GDP and housing more than half of the world's population, a figure projected to reach two-thirds by 2050. Yet urban areas remain highly exposed: 70 per cent of cities already experience climate impacts, and by 2030, disasters could cost cities three times more than today, pushing millions into urban poverty.[102]

Innovative approaches to resilient urban planning are emerging worldwide. Sponge city planning uses blue-green infrastructure (BGI), networks of parks, wetlands, bioswales, and water plazas, to absorb, store, and channel rainfall, reducing pressure on traditional drainage systems (Dawn). Copenhagen's "climate neighbourhoods" collect and guide rainwater via streets and parks, while Japan's Yokohama uses public-private detention systems to manage 82 mm/hour rainfall, reducing runoff by 75 per cent.[103] China's pilot Sponge Cities target 70–80 per cent precipitation absorption in urban areas, backed by government funding.[104]

Other models highlight integrated approaches: Jakarta's tidal barriers and community warnings manage complex flood risks; Bangladesh's community radio and Netherlands-backed Delta Plan 2100 combine early warning systems, spatial planning, and nature-based flood management. COP30 emphasises scaling such integrated infrastructure approaches, linking mobility, land use, water and transport networks so cities can absorb shocks rather than merely recover from them.

Pakistan's Progress and Challenges

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[101] *Prepared by NYU Marron Institute in collaboration with 100 Resilient Cities 100RC HANDBOOK Planning for Resilient Urban Growth Tools for Proactively Managing Rapid Urban Growth.* (2018). https://www.local2030.org/library/535/100RC-Handbook-Planning-for-Resilient-Urban-Growth.pdf

[102] How UNDP is Strengthening Cities' Resilience through Risk-Informed Urban Development. (2024). UNDP. https://www.undp.org/geneva/blog/how-undp-strengthening-cities-resilience-through-risk-informed-urban-development

[103] Muhammad Hassan Dajana, & Ramiz Shafqat. (2025, September 8). Urban storm-water management. Dawn. https://www.dawn.com/news/1940424

[104] Catalogue of Best Practices for Building Flood Resilience. (n.d.). https://www.gfdrr.org/sites/default/files/publication/A%20Catalogue%20of%20Best%20Practices%20for%20Building%20Flood%20Resilience.pdf

The majority of Pakistan's cities still lack integrated flood-resilient infrastructure. Informal settlements in major cities are especially vulnerable and often built on encroached waterways, lack drainage, and have weak access to services. Fragmented governance (multiple overlapping authorities for land use, drainage and transport) and weak enforcement of planning and building codes allow expansion in high-risk areas without adequate infrastructure or access to resilient mobility. In Punjab, Sindh and Khyber Pakhtunkhwa, provinces have initiated drainage rehabilitation projects and early-warning mapping, such as the Multi-Hazard Vulnerability and Risk Assessment for Rawalpindi, Islamabad, and Nowshera.[105] However, these tend to be localised or project-based. Major gaps also still remain in spatial planning: floodplains are not uniformly mapped or protected permeable surfaces are shrinking, and stormwater storage or detention infrastructure is underprovided. Urban mobility (walking, cycling) and not yet climate resilient or supported by policy.

Recommendations

Create a Punjab Urban Resilience Cell to coordinate municipal drainage, canal-command interfaces and transit planning (Lahore/Multan/Gujranwala), mandate floodplain zoning and permeable-surface targets for new developments, and ring-fence a provincial "urban shock" maintenance fund to rapidly repair roads, drainage and transit after shocks like the 2025 monsoon, link disbursements to agreed service-continuity KPIs.[106]

Establish a Sindh Coastal & Urban Resilience Board that legally maps nullahs, protects drainage corridors from encroachment, finances city-scale blue-green infrastructure in Karachi and Hyderabad (bioswales, detention basins, mangrove buffers), and integrates resilient public-transport corridors into redevelopment of flood-impacted neighbourhoods.[107]

Set up district-level resilience units linked to Peshawar and Mardan municipal authorities to deploy early-warning mobility response protocols, upgrade key evacuation routes and bridges to flood-resilient design, and fund mobile transit and temporary shelter systems that maintain connectivity for displaced urban populations.[108]

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[105] Ahmed, A. (2025, March 28). UN report uncovers twin cities' vulnerability to natural hazards. DAWN.COM. https://www.dawn.com/news/1900728

[106] NDRMF. (2024). Punjab Climate Change Policy and Action Plan.

[107] Government of Sindh Environment, Climate Change and Coastal Development Department. (2022). Sindh Climate Change Policy.

[108] Government of Khyber Pakhtunkhwa. (2022). Khyber Pakhtunkhwa climate change policy 2022 [Policy document]. https://epakp.gov.pk/wp-content/uploads/2022/09/Khyber-Pakhtunkhwa-Climate-Change-Policy-2022.pdf

Prioritise resilient coastal and peri-urban infrastructure in Quetta, Gwadar and Turbat by enforcing setback rules, introducing water-sensitive road and drainage design for flash-flood control, and investing in climate-resilient port access routes and multimodal corridors that secure supply chains during shocks.[109]

Launch an integrated canal-city coordination mechanism for southern districts (DG Khan, Bahawalpur, Rahim Yar Khan) to synchronise irrigation releases with urban drainage operations, upgrade critical arterial roads to flood-resilient standards, and create local multimodal market corridors that remain operable during high-flow events.

Use federal NAP/NDC instruments to mandate interoperability standards (data, KPIs, procurement) for provincial urban resilience plans; require a share of international adaptation finance flow directly to municipal resilience budgets; and fund five "urban resilience demonstrators" (one per province) that combine policy MOUs, shared dashboards and measurable mobility/continuity outcomes.[110]

Standardise a minimal national urban resilience indicator set (service hours, percent of impervious reduced, transit continuity index), require shared risk dashboards between meteorological, water and transport agencies, and prioritise maintenance- and operations-focused finance (not just capital projects) to avoid repeated post-flood reconstruction costs documented in the CPSER/CPEIR.[111]

[109] UNDP. (2022). *Balochistan Climate Change Policy*. https://www.undp.org/sites/g/files/zskgke326/files/2024-11/bccp_report.pdf

[110] Government of Pakistan. (2025, September 24). Pakistan NDC 3.0. United Nations Framework Convention on Climate Change. Retrieved from https://unfccc.int/sites/default/files/2025-09/Pakistan_NDC3.0_24 per cent20Sep.pdf

[111] *PAKISTAN Climate Public Expenditure and Institutional Review (CPEIR)*. (2015). UNDP.

4.4. Water management

Global and COP30 Context

Water is central to climate resilience, sustainable development, and human well-being. Climate change is altering the global water cycle, increasing variability in precipitation, inducing extreme weather events, and threatening both water quality and availability.[112] Glaciers that feed major rivers are rapidly shrinking, the Andes have lost 30–50 per cent of their glacier mass since the 1980s, and the Hindu Kush–Karakoram–Himalayan system, the "Third Pole," could lose half its volume by 2100 if no action is taken.[113]

Globally, over 4 billion people experience severe water scarcity for at least part of the year, with agriculture accounting for 72 per cent of freshwater withdrawals, followed by industry (15 per cent) and domestic use (13 per cent).[114] Twenty-five countries, home to a quarter of the global population, face extremely high water stress annually, highlighting the urgent need for integrated and climate-resilient water governance.

COP 30 will advance commitments from the Global Goal of Adaptation (GGA) and the Sharm el-Sheikh Water Adaptation Agenda, emphasising integrated water resource management, nature based solutions, urban-rural linkages to secure equitable access and mitigate urban flooding.[115]

Pakistan's Progress and Challenges

Pakistan is among the world's most water-stressed countries, projected to reach absolute water scarcity by 2035.[116] Per capita availability has plunged from 5,600 m^3 in 1947 to about 930 m^3 in 2023 and could fall below 500 m^3 by 2025.[117] Climate change, glacial melt, and erratic monsoons compound structural deficits: the country can store barely 30 days of water, far below the 120-day minimum for comparable semi-arid economies.[118] The NDC 3.0 and National Adaptation Plan (NAP 2023) both highlight rising stress from groundwater depletion—especially in Punjab and Sindh—sedimentation in reservoirs like

[112] Brief, U.-W. (n.d.). Climate Change and Water. https://www.unwater.org/sites/default/files/app/uploads/2019/09/UN_Water_Policy_Brief_Climate_Change_and_Water_web.pdf

[113] UNESCO World Water Assessment Programme. (2025). The United Nations World Water Development Report 2025, Mountains and glaciers: water towers. Unesco.org. https://unesdoc.unesco.org/ark:/48223/pf0000393070

[114] ibid.

[115] *Global goal on adaptation.* (2024). Unfccc.int. https://unfccc.int/topics/adaptation-and-resilience/workstreams/gga

[116] Mahmood, S. A., & Khalid, M. S. (2025, July 28). Water scarcity in Pakistan — a geopolitical ticking time bomb. DAWN.COM. https://www.dawn.com/news/1913435

[117] ibid.

[118] Water Security in Pakistan: Issues and Challenges. (2016). UNDP.

Tarbela, and saline intrusion in coastal zones. Inefficient irrigation, which loses nearly 60 per cent of diverted water, intensifies scarcity, while inadequate sanitation and storage infrastructure constrain domestic and industrial resilience.[119]

Transboundary dynamics and governance weaknesses further aggravate risk. Water releases from upstream Indian dams on the Ravi, Chenab, and Sutlej during monsoon peaks routinely worsen downstream flooding. Although the Indus Waters Treaty offers a legal framework, coordination on flood-release management remains limited, undermining preparedness. Institutional fragmentation, across federal, provincial, and municipal levels, hampers implementation of integrated water management envisioned in the CPSER and NAP. Without cohesive planning, equitable allocation, and investment in climate-resilient water infrastructure, Pakistan's agriculture, cities, and ecosystems will remain acutely exposed to both scarcity and flooding. South Asia's water scarcity is exacerbated by climate change, population growth, and unsustainable water use.

Recommendations

Pakistan's continued reactive approach to natural disasters evident during the past floods highlights persistent weaknesses in policy implementation and governance. Despite early warnings from the Meteorological Department as far back as May 2025, preparedness across departments remained inadequate when the floods struck in July–August. This cycle of rescue, relief, and recovery cannot continue. Going forward, Disaster Risk Reduction (DRR) must be mainstreamed as a core pillar of climate change adaptation policy, integrated into planning, budgeting, and institutional coordination at all levels. Without such a proactive shift, Pakistan risks not only recurrent disaster losses but also diminishing international support for adaptation and climate resilience efforts.

Adopt Integrated Water Resource Management (IWRM): Operationalize the NAP's cross-sectoral approach by establishing a National Water Resilience Council to align federal, provincial, and basin-level actions. Integrate data from IRSA, SUPARCO, and PMD into a real-time decision system for allocations, drought early warning, and glacial melt forecasting

Promote Efficient Irrigation and Groundwater Recharge in Punjab. Prioritize canal lining, drip irrigation, and managed aquifer recharge to reverse groundwater decline (–1 m/year in southern

[119] Brief, U.-W. (n.d.). Climate Change and Water. https://www.unwater.org/sites/default/files/app/uploads/2019/09/UN_Water_Policy_Brief_Climate_Change_and_Water_web.pdf

districts). Use the Punjab Irrigation Department's command area development plan to integrate NDC 3.0's water–energy–food nexus approach and incentivize water-efficient cropping.[120]

Restore Delta and Coastal Freshwater Flows in Sindh. Enforce the NAP's Indus Delta restoration measures to combat saltwater intrusion, expand mangrove rehabilitation, and modernize urban drainage in Karachi and Hyderabad. Promote rainwater harvesting and treated wastewater reuse for peri-urban agriculture.[121]

Enhance Storage and Drought Resilience in Balochistan. Develop small and medium check dams and improve canal conveyance to capture ephemeral flows under the CPSER priority for arid basin management. Implement solar-powered groundwater monitoring and expand drought-resilient cropping systems to stabilize rural livelihoods.[122]

Safeguard Glacial and Watershed Ecosystems in Khyber Pakhtunkhwa. Strengthen the Upper Indus Basin initiative by integrating community-based watershed management, early warning systems, and glacial lake outburst flood (GLOF) monitoring in high-altitude catchments. Enhance resilience of irrigation and municipal supply networks in Swat and Chitral valleys.[123]

Reinstate data sharing under the Indus Waters Treaty and establish a joint Indus Climate Data Platform with international partners to manage flood releases and drought forecasting

Upgrade treatment plants, reuse systems, and pipelines through blended climate finance and public–private partnerships (PPP) to meet SDG 6 targets.

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120 NDRMF. (2024). Punjab Climate Change Policy and Action Plan.

121 Government of Sindh Environment, Climate Change and Coastal Development Department. (2022). Sindh Climate Change Policy.

122 elmer. (2024). *Processing Schedules of Country Partnership Strategies*. Asian Development Bank. https://www.adb.org/where-we-work/documents/country-strategies-programs-under-preparation

123 Environmental Protection Agency, Khyber Pakhtunkhwa. (2022). *Khyber Pakhtunkhwa climate change policy 2022*. https://epakp.gov.pk/wp-content/uploads/2022/09/Khyber-Pakhtunkhwa-Climate-Change-Policy-2022.pdf

4.5 Solid Waste Management

Global and COP30 Context

The waste sector directly contributes only 3–5 per cent of global greenhouse gas (GHG) emissions over a 100-year period, but its indirect mitigation potential, through prevention, recycling, and energy recovery, can reach up to 20 per cent, a largely untapped resource in national climate strategies.[124] Global waste generation is projected to increase by over 70 per cent by 2050 compared with 2016 levels, driven by population growth and economic development.[125]

Despite its climate significance, the sector remains underrepresented in many Nationally Determined Contributions (NDCs). While more than half of countries referenced solid waste in their revised 2025 NDCs, most do not specify actions, targets, or indicators.[126] Globally, waste prevention, the most impactful strategy, is included in only 34 per cent of NDCs, reflecting a critical gap in both policy and practice.[127]

Emerging examples in South Asia demonstrate potential pathways: Bangladesh and Sri Lanka implement incineration, composting, and Waste-to-Energy (WtE) plants with emission reduction targets, while Nepal plans widescale treatment and energy recovery by 2030.[128] These initiatives align with the "7 Rs" framework, rethink, reuse, recycle, repurpose, repair, reform, refuse, which is essential to transition toward sustainable consumption and circular economies.[129]

Pakistan's Progress and Challenges

Pakistan produces nearly 2 million tonnes of plastic waste annually, but mismanagement is severe: approximately 86 per cent of waste is uncollected or improperly disposed, clogging drains, littering streets, and contaminating rivers.[130] Only 26 per cent of plastics are collected nationwide, with rural

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[124] Atlas on Waste Management and Climate Change Mitigation FOCUS ON INTEGRATING WASTE INITIATIVES INTO NDCs WASTE & CLIMATE CHANGE. (n.d.). Retrieved October 10, 2025, from https://www.iswa.org/wp-content/uploads/2025/09/Atlas-on-Waste-Management-and-Climate-Change-Mitigation_compressed.pdf

[125] ibid.

[126] Government of Pakistan. (2025, September 24). Pakistan NDC 3.0. United Nations Framework Convention on Climate Change. Retrieved from https://unfccc.int/sites/default/files/2025-09/Pakistan_NDC3.0_24 per cent20Sep.pdf

[127] Atlas on Waste Management and Climate Change Mitigation FOCUS ON INTEGRATING WASTE INITIATIVES INTO NDCs WASTE & CLIMATE CHANGE. (n.d.). Retrieved October 10, 2025, from https://www.iswa.org/wp-content/uploads/2025/09/Atlas-on-Waste-Management-and-Climate-Change-Mitigation_compressed.pdf

[128] A. Khanal, Giri, S., Oyebode, O. J., Omijeh, J. E., & A. Khanal. (2024). Policy Measures, Practices and Challenges of Waste-to-Energy: Perspectives from Nigeria and Nepal. *Journal of Environmental Informatics Letters*. https://doi.org/10.3808/jeil.202400124

[129] SDPI. (2023). *Sherry Rehman for embracing 7Rs strategy to end plastic pollution through circular economy-6665-News*. Sdpi.org. https://sdpi.org/sherry-rehman-for-embracing-7rs-strategy-to-end-plastic-pollution-through-circular-economy/news_detail

[130] *PLASTIC POLICIES IN PAKISTAN Country Profile 2*. (n.d.). https://www.switch-asia.eu/site/assets/files/4387/plastic_policies_pk.pdf

coverage at a mere 5 per cent.[131] Recycling rates remain extremely low at around 3 per cent, despite potential capacity up to 18 per cent, largely handled by the informal sector.[132]

Municipal solid waste collection itself is inadequate, with only half of waste being collected in 2022. Poor data, weak infrastructure, fragmented governance, and minimal incentives hinder progress. Current national policies also provide limited integration with climate action, despite the sector's role in emissions mitigation and potential for energy recovery.[133]

Recommendations

Expand the *Suthra Punjab* programme: implement door-to-door collection in all districts, outsource formal collection services with performance monitoring (vehicle tracking, cleanliness indexes), and establish Material Recovery Facilities (MRFs) in major cities like Lahore and Multan, with targets for plastic segregation and reuse.[134]

In Karachi and Hyderabad, establish publicly-run or PPP waste-to-energy / composting plants, crack down to enforce already existing bans and fees for plastic bags, and strengthen drainage clearance programmes to stop plastic and waste clogging nullahs (waterways) to reduce flood risk and emissions from open burning.

Khyber Pakhtunkhwa (KPK): Provide incentives for community-based recycling schemes, upgrade waste collection in remote and hilly regions, deploy small-scale composting for organic waste, and ensure solid waste planning is integrated into district development plans with climate-sensitive mapping.[135]

Balochistan: Prioritise landfill upgrades (engineered, lined, with leachate and methane control) in Gwadar, Quetta and coastal districts; introduce smart collection systems using digital tracking; support formalisation and capacity-building of informal waste workers.[136]

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131 Pakistan National Action Roadmap to Reduce Plastic Pollution.pdf | Powered by Box. (2025). Box.com. https://weforum.ent.box.com/s/97krhj458erx9x3a64vpn5uaafr2wo8w

132 ibid.

133 Atlas on Waste Management and Climate Change Mitigation FOCUS ON INTEGRATING WASTE INITIATIVES INTO NDCs WASTE & CLIMATE CHANGE. (n.d.). Retrieved October 10, 2025, from https://www.iswa.org/wp-content/uploads/2025/09/Atlas-on-Waste-Management-and-Climate-Change-Mitigation_compressed.pdf

134 *Suthra Punjab | Punjab Portal.* (2023). Punjab.gov.pk. https://punjab.gov.pk/suthra-punjab

135 Environmental Protection Agency, Khyber Pakhtunkhwa. (2022). *Khyber Pakhtunkhwa climate change policy 2022.* https://epakp.gov.pk/wp-content/uploads/2022/09/Khyber-Pakhtunkhwa-Climate-Change-Policy-2022.pdf

136 Government of Balochistan & United Nations Development Programme. (2024). *Balochistan climate change policy* [PDF]. https://www.undp.org/sites/g/files/zskgke326/files/2024-11/bccp_report.pdf

Integrated Waste Management and Circular Economy: Establish nationwide frameworks that link waste management across collection, sorting, recycling, and recovery, embedding circular economy principles into national policies and incentives.[137]

Waste Prevention: Reduce waste at source through eco-design, reuse, repair, food waste reduction, and behavioral change campaigns. Preventing waste is the most effective measure to lower GHG emissions across production, transport, and disposal.[138]

Ending Harmful Disposal Practices: Eliminate open burning and uncontrolled landfilling, improve organic waste management, and implement engineered landfills with proper methane capture to reduce emissions and protect public health.[139]

Energy Recovery: Utilize waste-to-energy solutions, anaerobic digestion, and landfill gas capture to reduce fossil fuel use and enhance local energy security. Integration with urban energy networks can provide multiple climate and economic benefits.[140]

Recycling and Material Recovery: Support local recycling loops and the informal sector to maximize the substitution of virgin materials, reduce natural resource pressures, and create sustainable livelihoods.[141]

[137] *Waves of Plastics: A Snapshot of Marine Plastic Pollution in South Asia*. (2024). https://documents1.worldbank.org/curated/en/099933108202431142/pdf/IDU-8e0bbc27-c078-4328-a4e0-6dc43e77b919.pdf

[138] Atlas on Waste Management and Climate Change Mitigation FOCUS ON INTEGRATING WASTE INITIATIVES INTO NDCs WASTE & CLIMATE CHANGE. (n.d.). Retrieved October 10, 2025, from https://www.iswa.org/wp-content/uploads/2025/09/Atlas-on-Waste-Management-and-Climate-Change-Mitigation_compressed.pdf

[139] ibid.

[140] ibid.

[141] ibid.

Human and Social Development

5.1. Promoting Resilient Health Systems

Global and COP30 Context

At COP30, the Belém Health Action Plan (BHAP) will serve as a central framework for advancing climate-resilient health systems. BHAP emphasizes adaptation, equity, climate justice, and social participation, mobilizing global action to build environmentally sustainable health systems.

Health is now at the forefront of the climate crisis. Between 2030 and 2050, climate change is expected to cause approximately 250,000 additional deaths per year from malnutrition, malaria, diarrhoea, and heat stress, according to the WHO.[142] Europe, the fastest-warming continent, faces the potential closure of over a 1000 hospitals by 2100 due to extreme weather events.[143] Health systems themselves contribute to climate change, with the sector responsible for 4.6 per cent of global net emissions[144]. In 2020 alone, 98 million more people experienced food insecurity than the 1981–2010 average (WHO).[145] Around 930 million people spend at least 10 per cent of household budgets on health, with climate-induced shocks pushing an estimated 100 million people into poverty annually (WHO).[146]

Pakistan's Progress and Challenges

A heavier-than-usual monsoon since June 2025 has caused floods and landslides affecting over 6 million people. Health experts warn of rising cases of cholera, dysentery, and malaria, particularly in overcrowded displacement camps where access to clean water and sanitation remains scarce.[147] The British Red Cross and local specialists caution that the lack of toilets, handwashing facilities, and hygiene infrastructure poses a serious outbreak risk. According to Amnesty International (2025), children and

[142] World Health Organization. (2023, October 12). Climate Change. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health

[143] Hospital infrastructure at growing risk of shutdown due to climate change. (2023). Europa.eu. https://climate-adapt.eea.europa.eu/en/observatory/news-archive-observatory/hospital-infrastructure-at-growing-risk-of-shutdown-due-to-climate-change

[144] Climate change | Health Care Without Harm - Europe. (2025, February 25). Noharm.org. https://europe.noharm.org/climate-change

[145] World Health Organization. (2023, October 12). Climate Change. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health

[146] Jameel, A. L. (2025, February 5). Heating up healthcare | Abdul Latif Jameel®. Abdul Latif Jameel. https://alj.com/en/perspective/heating-up-healthcare-addressing-the-health-consequences-of-a-warmer-world/

[147] Ghani, F. (2025, September 23). Pakistan floods spark cholera fears amid other rising health risks. Al Jazeera. https://www.aljazeera.com/news/2025/9/23/pakistan-floods-spark-cholera-fears-amid-other-rising-health-risks

older people in Pakistan are suffering disproportionately from extreme weather events, as hospitals and disaster response systems struggle to provide adequate care.[148]

Public health expenditure is below 1 per cent of GDP, and climate emergencies have further strained already limited infrastructure.[149] The government's National Adaptation Plan (2023) identifies health resilience as a priority, and Pakistan's participation in WHO's ATACH initiative marks a step toward integrating health into climate adaptation.[150] Pakistan's Ministry of Planning, Development and Special Initiatives (MoPD&SI) has taken steps to prioritise mental health in the national development agenda through the 5Es Framework, which emphasises accessibility, inclusivity, and social justice in healthcare delivery. The ministry's Mental Health Strategic Planning and Coordination Unit is piloting a multilayered digital MHPSS model in Khyber Pakhtunkhwa (KP), training 500 community volunteers and 80 doctors to provide early support and referral services.[151]

Recommendations

Punjab should prioritise retrofitting hospitals and clinics to meet climate-resilient standards, ensuring solar backup for critical facilities, and integrating heatwave early warning systems into district health networks in cities such as Lahore and Multan.[152] Sindh needs to rebuild damaged facilities with resilient materials, strengthen disease surveillance for waterborne infections and integrate maternal and child health services into emergency preparedness.[153]

Khyber Pakhtunkhwa must scale up the digital MHPSS model beyond pilot districts, strengthen disease surveillance in northern valleys, and expand mobile health outreach.[154] Balochistan should prioritise solar-powered rural health units, expand mobile clinics, and introduce water-quality monitoring around health facilities to curb the spread of diarrhoeal diseases.[155] Gilgit-Baltistan and Azad Jammu and

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148 Pakistan: Climate disasters increasing risks of death and disease amongst children and older people – new report. (2025, May 5). Amnesty International. https://www.amnesty.org/en/latest/news/2025/05/pakistan-climate-disasters-increasing-risks-of-death-and-disease-amongst-children-and-older-people-new-report/

149 Pakistan's health expenditure remains under 1% of GDP. (2025, June 10). Profit by Pakistan Today. https://profit.pakistantoday.com.pk/2025/06/10/pakistans-health-expenditure-remains-under-1-of-gdp/

150 Building Resilient Health Systems in Pakistan through Equity-Centered Adaptation. (2025, July 25). Atachcommunity.com. https://www.atachcommunity.com/our-impact/case-studies/building-resilient-health-systems-in-pakistan-through-equity-centered-adaptation/

151 Humayun, A. (2025, May 20). Improving mental healthcare. DAWN.COM. https://www.dawn.com/news/1912342

152 Government of Punjab. (2024). *Climate Resilient Punjab: Vision & Action Plan 2024*. https://ndrmf.pk/wp-content/uploads/2024/08/Punjab_Climate_Change_Policy_Action_Plan__1723738609_compressed.pdf

153 Government of Sindh Environment, Climate Change and Coastal Development Department. (2022). Sindh Climate Change Policy.

154 Environmental Protection Agency, Khyber Pakhtunkhwa. (2022). *Khyber Pakhtunkhwa climate change policy 2022*. https://epakp.gov.pk/wp-content/uploads/2022/09/Khyber-Pakhtunkhwa-Climate-Change-Policy-2022.pdf

155 Government of Balochistan & United Nations Development Programme. (2024). Balochistan climate change policy [PDF]. https://www.undp.org/sites/g/files/zskgke326/files/2024-11/bccp_report.pdf

Kashmir need improved emergency medical preparedness for landslides and floods, including equipping remote health centres with cold-chain storage, solar power, and essential medicines.

At the national level, Pakistan should integrate climate and health risk assessments into all new health infrastructure projects and align the National Health Vision 2025 with the Belém Health Action Plan.[156] Establishing a National Climate–Health Observatory can help coordinate early warning data from the NDMA, the Meteorological Department and provincial health agencies. National financing guidelines should earmark adaptation funds for health infrastructure, disease surveillance and mental health. Pakistan should also invest in building a climate-ready health workforce by introducing climate resilience and environmental health training in medical and nursing curricula.

Globally, the Belém Health Action Plan should commit to a measurable framework for financing and monitoring climate–health systems, with dedicated support for vulnerable countries such as Pakistan.

[156] Government of Pakistan; Ministry of National Health Services, Regulation & Coordination. (2016). *National Health Vision Pakistan 2016-2025* [PDF]. https://extranet.who.int/countryplanningcycles/sites/default/files/planning_cycle_repository/pakistan/national_health_vision_2016-25_30-08-2016.pdf

5.2 Reducing the effects of climate change on eradicating hunger and poverty

Global and COP30 Context

Climate change is a key driver of global hunger and poverty, primarily through its impacts on agricultural productivity. Recurring floods, droughts, and other extreme weather events degrade soils, reduce crop yields, and compromise food quality. At COP28, governments agreed that addressing hunger and poverty must become central pillars of climate adaptation and financing, and COP30 builds on this by aligning the Action Agenda with efforts to strengthen climate-resilient food systems, protect livelihoods, and integrate social protection into climate strategies.[157]

Globally, the number of people suffering from acute food insecurity rose sharply, from 135 million in 2019 to 345 million in 82 countries by mid-2022, driven by climate shocks, the war in Ukraine, supply chain disruptions, and COVID-19 economic fallout.[158] Food price spikes in 2021 pushed an estimated 30 million additional people in low-income countries toward food insecurity.[159] Approximately 80 per cent of those most at risk from climate-driven crop failures are in Sub-Saharan Africa, South Asia, and Southeast Asia, where rural populations are disproportionately poor.[160] The World Food Programme estimates that a 2°C increase in global average temperature could push an additional 189 million people into hunger, particularly in low-income countries dependent on rainfed agriculture.[161] Without intervention, 43 million people in Africa could fall below the poverty line by 2030 due to declining agricultural productivity.[162]

Pakistan's Progress and Challenges

Pakistan faces a particularly acute intersection of climate vulnerability, poverty, and hunger. Over 60 percent of the population depends directly or indirectly on agriculture for their livelihoods.[163] The 2025 floods once again destroyed large areas of standing crops, displaced millions of people, and deepened

[157] Cullinan, M. (2023, November 30). COP28: The Climate Crisis Is a Hunger Crisis. Action against Hunger. https://www.actionagainsthunger.org/story/cop28-the-climate-crisis-is-a-hunger-crisis/

[158] World Bank Group. (2022). Climate explainer: Food security and climate change. World Bank. https://www.worldbank.org/en/news/feature/2022/10/17/what-you-need-to-know-about-food-security-and-climate-change

[159] ibid.

[160] ibid.

[161] UN World Food Programme (WFP). (2021, October 14). Wfp.org. https://www.wfp.org/news/unprecedented-hunger-follow-wake-climate-crisis-wfp-calls-urgent-action-world-food-day

[162] World Bank Group. (2022). Climate explainer: Food security and climate change. World Bank. https://www.worldbank.org/en/news/feature/2022/10/17/what-you-need-to-know-about-food-security-and-climate-change

[163] Syed, A., Raza, T., Bhatti, T. T., & Eash, N. S. (2022). Climate Impacts on the agricultural sector of Pakistan: Risks and solutions. Environmental Challenges, 6, 100433. https://doi.org/10.1016/j.envc.2021.100433

existing inequalities. The Global Hunger Index ranks South Asia as the second most undernourished region, and Pakistan 92nd among 116 declared food-insecure countries.[164] In Pakistan, 16 per cent of the urban population and roughly double that in rural areas are food insecure, with projections indicating that 38 per cent of the population may face food insecurity by 2031.[165]

The World Food Programme estimates that 82 percent of households in Pakistan cannot afford a healthy diet, while almost half of total household expenditure is spent on food.[166] Acute malnutrition affects more than two million children in parts of Sindh, KP and Balochistan, and climate-related disruptions continue to raise food prices and reduce nutritional diversity.[167] Smallholder farmers, who dominate rural Pakistan, are often unable to absorb shocks, while urban populations face higher food prices and limited access to nutritious diets. Pakistan's National Adaptation Plan identifies food security and poverty reduction as top priorities, emphasising the need to protect smallholder farmers and integrate climate adaptation into poverty alleviation programmes.

Recommendations

Punjab must strengthen climate-smart agriculture through drought-tolerant crop varieties, efficient irrigation, and regenerative soil management.[168] Expanding crop diversification and developing storage and cold-chain facilities can reduce post-harvest losses and stabilise incomes. **Sindh's** coastal and riverine districts require a shift toward flood-resilient farming systems that use raised fields and salt-tolerant crops. Investments in drainage, embankments and community-based disaster response will help reduce crop and livelihood losses.[169]

Khyber Pakhtunkhwa's mountainous and semi-arid terrain demands watershed management, terracing and reforestation to prevent soil erosion and maintain agricultural productivity.[170] Expanding agroforestry and small-scale irrigation can diversify rural incomes while protecting natural ecosystems. Balochistan should focus on solar-powered irrigation, small water storage structures and the promotion

[164] Ikram Junaidi. (2022, August 17). Pakistan ranked 92nd out of 116 countries on Global Hunger Index: report. Dawn. https://www.dawn.com/news/1705252

[165] Abbas, S., Haider, A., Shazia Kousar, Lu, H., Lu, S., Liu, F., Li, H., Miao, C., Feng, W., Ahamad, M. I., Mehmood, M. S., & Zulqarnain, R. M. (2025). Climate variability, population growth, and globalization impacting food security in Pakistan. Scientific Reports, 15(1). https://doi.org/10.1038/s41598-025-88916-2

[166] World Food Programme. (2024). *Pakistan | World Food Programme*. Www.wfp.org. https://www.wfp.org/countries/pakistan

[167] IPC Global; Government of Pakistan. (Year). *Pakistan acute malnutrition analysis: Final report*. https://fscluster.org/sites/default/files/documents/ipc_pakistan_acute_malnutrition_analysis_final_report.pdf

[168] Government of Punjab. (2024). Climate Resilient Punjab: Vision & Action Plan 2024. https://ndrmf.pk/wp-content/uploads/2024/08/Punjab_Climate_Change_Policy_Action_Plan__1723738609_compressed.pdf

[169] Government of Sindh Environment, Climate Change and Coastal Development Department. (2022). Sindh Climate Change Policy.

[170] Environmental Protection Agency, Khyber Pakhtunkhwa. (2022). *Khyber Pakhtunkhwa climate change policy 2022*. https://epakp.gov.pk/wp-content/uploads/2022/09/Khyber-Pakhtunkhwa-Climate-Change-Policy-2022.pdf

of resilient crops such as pulses and millet that require less water and can withstand heat.[171] Developing community-based rangeland management and restoring degraded lands can improve food security for pastoral communities.

Pakistan should integrate climate resilience into its social protection programmes, such as the Benazir Income Support Programme, by linking cash transfers to resilience-building measures like climate-smart farming, afforestation and land restoration. Expanding weather-indexed crop insurance, concessional credit for climate-resilient inputs, and emergency livelihood grants can protect vulnerable populations from climate shocks.

Internationally, concessional finance, technology transfer and partnerships under the COP30 framework will be critical to support Pakistan's adaptation and food security goals. Donor coordination through climate funds such as the Green Climate Fund and the Loss and Damage Fund should prioritise investments in resilient food systems, rural infrastructure and social protection.

[171] Government of Balochistan & United Nations Development Programme. (2024). *Balochistan climate change policy* [PDF]. https://www.undp.org/sites/g/files/zskgke326/files/2024-11/bccp_report.pdf

5.3 Education, Capacity-Building, and Job Creation to Address Climate Change

Global and COP30 Context

Education is the strongest predictor of climate change awareness and plays a catalytic role in mitigation and adaptation by shaping mindsets, behaviours, skills, and innovation. Yet, the sector remains severely underfunded: in 2021, only 1.5 per cent of climate finance went to education.[172]

Climate change disrupts education systems worldwide. Countries lost, on average, 11 days of instruction per year due to climate-related school closures, with low-income countries losing 18 days per year (nearly 10 per cent of the academic year) while high-income countries lost only 2.4 days.[173] Even when schools are open, rising temperatures can reduce learning: in Brazil, students in the poorest municipalities may lose up to 0.5 years of learning due to climate stress.[174]

According to the International Labour Organization, transitions to renewable energy and green sectors could create some 24 million new jobs globally even as fossil fuel sectors lose jobs.[175] At the same time, about 70 million workers will require reskilling to adapt to climate-smart technologies and shifting labour demands.[176] There is also growing recognition from multilateral finance institutions that investing in green skills yields high returns: for every dollar spent on training workers in clean technologies the social and economic returns tend to be many times higher due to avoided health, environmental, and job loss costs.

Pakistan's Progress and Challenges

In Pakistan, climate shocks have severely affected schooling. Following the 2022 floods, 92 per cent of affected households remained uncertain six months later about school reopening, with 3.5 million

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[172] World Bank Group. (2024, September 4). *More than 400 Million Students Affected by Climate-Related School Closures since 2022*. World Bank; World Bank Group. https://www.worldbank.org/en/news/press-release/2024/09/04/education-for-climate-action-400m-students-affected-climate-related-school-closures

[173] United Nations Office for Disaster Risk Reduction. (2024). *Choosing our Future: Education for Climate Action*. https://iddrr.undrr.org/media/100805/download?startDownload=20251010

[174] Group, W. B. (2024, December 5). *From Heat to Hope: The Overhaul of Public Schools in Brazil's Tocantins State*. World Bank; World Bank Group. https://www.worldbank.org/en/news/feature/2024/12/03/from-heat-to-hope-the-overhaul-of-public-schools-in-brazil-tocantins-state

[175] 24 million jobs to open up in the green economy. (2018, May 14). International Labour Organization. https://www.ilo.org/resource/news/24-million-jobs-open-green-economy

[176] World Economic Forum. (2025). *The future of jobs report 2025*. https://reports.weforum.org/docs/WEF_Future_of_Jobs_Report_2025.pdf

children experiencing disrupted schooling and 1 million at risk of dropping out.[177] Children from lower-income and less-educated households were disproportionately impacted. Youth survey data from Pakistan indicates that while a majority of young people feel worried about climate change and believe governments should act, fewer than one third report they feel confident they can explain it well, showing gaps in climate education.[178]

Evidence shows that education improves climate resilience in agriculture: farmers with at least a lower secondary education are more likely to diversify crops, adjust planting schedules, and use farm insurance to manage climate risks. Post-flood surveys indicate 97 per cent of parents support climate change education in schools, while climate knowledge among young people remains low, particularly in vulnerable countries like Pakistan (19 per cent of youth) (World Bank).

On capacity-building and jobs, initiatives such as the CLIP's Solar Workforce Academy are training job-ready solar professionals and supporting early stage climate tech startups. (Climate Innovation Pakistan) Punjab has also launched a Climate Internship Program offering 2,000 internships with stipends to graduates in environmental fields. (Punjab government) However, systemic challenges remain: educational curricula in many provinces do not yet consistently include climate topics, vocational institutions lack climate-smart technology training, and many green jobs are informal and lack regulation or security.

Recommendations

Punjab should build on its Climate Internship Program by expanding internships into rural districts, linking hands-on green technology training with local employers in solar, sustainable agriculture, and construction. This will help ensure that youth trained in urban centers also find work in smaller towns. Sindh should institutionalize climate change education into senior secondary school curricula, invest in teacher training for climate literacy and environmental science, and support community-based programs that enable women and girls to access green skills, especially in clean energy and sustainable agriculture. Khyber Pakhtunkhwa should scale up vocational training institutes to include climate-smart trades such as solar installation, energy-efficient building techniques, watershed restoration, and early warning technologies, offering accredited certification that enables mobility. Balochistan must focus job creation via off-grid renewable energy projects and climate resilient infrastructure works,

177 *How are the children of Pakistan's 2022 floods faring?* (n.d.). World Bank Blogs. https://blogs.worldbank.org/en/endpovertyinsouthasia/how-are-children-pakistans-2022-floods-faring

178 Reis Lopez Rello, & Ackers, J. (2021). Rising to the challenge: Youth perspectives on climate change and education in Pakistan. UNICEF. https://www.unicef.org/rosa/media/13991/file/Rising%20to%20the%20Challenge:%20Youth%20Perspectives%20on%20Climate%20Change%20and%20Education%20in%20Pakistan.pdf

ensuring local workers are trained in installation, maintenance, and safety, thus turning geographic remoteness into a comparative advantage.

Nationally, Pakistan should mandate the inclusion of climate change education across all levels of formal schooling from primary through higher education, revising curricula and providing teacher training; establish or strengthen national just transition funds that support workers displaced from fossil fuel or climate-sensitive sectors to retraining and relocation; promote public-private partnerships for green sector workforce development, with incentives for employers to hire youth from marginalized areas; ensure that green job creation is accompanied by decent work standards, social protection and safety, and expand digital learning tools to deliver climate and environmental education to remote and underserved communities.

Globally, international funders and climate finance mechanisms should earmark portions of adaptation and climate education funding for capacity building and job creation in low-income and climate-vulnerable countries; multilateral agencies should facilitate exchange programs so that Pakistan can learn from successful models elsewhere; global bodies such as UNESCO, ILO and UNFCCC should promote standardized climate literacy benchmarks and skill frameworks that help countries design and evaluate climate education and green job programs; technical assistance should help integrate climate topics into teacher education and curriculum reform with attention to gender and regional equity.

5.4. Culture, cultural heritage protection and climate action

Global and COP30 Context

Climate change as it relates to cultural heritage, is an emerging area of research and policy. Its relevance first reached the COP25 in Madrid (2019) and has become increasingly visible at subsequent COPs (European Parliament). Climate change is a major threat to World Heritage properties: shrinking glaciers, coral bleaching, more frequent forest fires, and droughts are already causing damage. UNESCO notes that World Heritage forests absorb 190 million tons of CO_2 annually, while marine World Heritage sites store 15 per cent of the world's blue carbon assets. It is estimated that nearly one third of World Heritage cities are coastal and face risks from sea level rise, erosion and extreme weather. Climate change not only damages physical monuments but erodes cultural identity, community cohesion, and traditional knowledge that often holds adaptation insight. Global policy efforts including COP28 urged inclusion of cultural heritage protection in national adaptation plans and risk assessments. Beyond natural sites, air pollution and climate stressors have damaged historical monuments worldwide, such as black crust formation on Delhi's Red Fort and discolouration of the Taj Mahal (BBC). International conventions such as UNESCO's World Heritage Convention, Intangible Heritage Convention and the upcoming UNESCO Culture 2030 Indicators programme are being leveraged globally to enhance policy and financing for heritage protection, disaster risk preparedness and climate-aware conservation.

Pakistan's Progress and Challenges

Pakistan's rich cultural heritage is under growing threat from climate impacts and natural disasters. The 2022 monsoon floods caused severe damage to historical sites, particularly in Sindh, including the Archaeological Ruins at Mohenjo-Daro and the Historic Monuments at Makli, with structural damages valued at around USD 6 million (UNESCO PDNA 2022). Overall, the floods caused over USD 30 million in damage to cultural heritage. UNESCO mobilised funds totalling about US$150,000 from its World Heritage Fund to assess damage and take remedial measures in Sindh, plus US$50,000 for restoration at Makli. Rising temperatures as high as 50-51°C in Mohenjo-Daro are leading to salt crystallization in ancient sun-dried bricks that cause deterioration and leaning walls. In Khyber Pakhtunkhwa, over 14 heritage sites including Buddhist monasteries and rock reliefs in Swat were damaged by heavy rains and flooding. Rising temperatures (+0.6°C over the past century) further exacerbate risks to fragile historical structures. UNESCO warns that without immediate intervention, one in four heritage sites in Pakistan could face irreversible damage by 2050 (Samaa). Mohenjo-daro, once one of the best-preserved South Asian World Heritage Sites, is at risk of losing its status, which would cut off vital protection, funding, and preservation aid (Architecture). Archaeologists stress the urgent need for climate adaptation strategies for heritage protection, including at sites like the Late Buddhist Rock Heritage of Swat (DAWN).

Recommendations

Punjab's heritage is extensive from the Mughal and Gandhara periods and should be protected through climate-aware restoration, use of weather-resilient materials and structural reinforcement. Including heritage impact assessments in infrastructure planning around Lahore Fort, Badshahi Mosque and Taxila will help prevent damage from heat, air pollution and water ingress. Sindh must scale up its partnership with UNESCO and local governments to provide systematic site-by-site vulnerability assessments for World Heritage Sites such as Mohenjodaro and Makli. The province should invest in early warning systems for extreme rainfall events and establish routine maintenance and disaster-proofing measures in heritage architecture, especially tombs and monuments built with sun-dried bricks.

In Khyber Pakhtunkhwa, where Swat, Takht-i-Bahi, Hund and other Gandharan archaeological sites are at risk, there is a need for greater digital documentation, mapping and preventive conservation programmes. Conservation curricula and training for archaeologists, heritage managers and local craftspeople can build local capacity. Balochistan, with heritage sites and forts in arid zones and coastal areas, should prioritise protective interventions against erosion and sea-level rise, invest in sustainable drainage and local community guardianship systems to ensure heritage upkeep amid environmental stress.

At the national level, Pakistan should integrate cultural heritage protection into climate risk and adaptation frameworks including National Adaptation Plan and disaster risk management policies. A dedicated heritage finance mechanism should be established to fund conservation, restoration and preventive maintenance of at-risk sites. Legislation should be updated to require heritage risk assessments before any development projects near protected sites. The Ministry of Culture should collaborate with Climate Change Authority, Planning and Development, and provincial governments to build technical capacity for preventive conservation including training in climate-aware design, materials science and heritage-specific disaster preparedness.

Globally, international climate finance should more explicitly include cultural heritage components in adaptation funding; multilateral institutions and UNESCO should develop standard metrics for heritage site climate vulnerability and resilience. There should be knowledge sharing and technical support for countries with large heritage inventories under climate threat to adopt best practices in preventive conservation, traditional knowledge integration, and resilient architectural and archaeological practice.

Cross-cutting Issues

6.1 Climate and sustainable finance, mainstreaming climate in investments and insurance

Global and COP30 Context

Developing countries (excluding China) need USD 2.7 trillion annually by 2030 to meet climate and nature-related goals, with USD 1.3 trillion from abroad and USD 1.4 trillion from domestic sources (IHLEG). In 2024, multilateral development banks (MDBs) delivered a record US$137 billion in climate finance, of which about US$85.1 billion went to mitigation in low- and middle-income countries and US$26.3 billion to adaptation. The NCQG's USD 300 billion target represents the largest climate finance commitment ever, but finance needs far exceed this. Fifteen years ago, developed countries pledged USD 100 billion per year by 2020, a target missed in 2020–21 and only met in 2022. COP29 outcomes highlighted a widening gap between pledges and needs, with adaptation finance largely underestimated and the majority of finance still flowing as loans, worsening debt risks in lower-income countries. The Global Shield initiative and other insurance-for-risk financing programmes are being scaled up to provide pre-arranged finance that triggers automatically in disasters, easing fiscal pressures on governments and facilitating quicker recovery. Investment frameworks are increasingly expected to embed environmental, social, and governance (ESG) criteria, climate risk assessments, and transition planning.

Pakistan's Progress and Challenges

Pakistan needs an estimated climate finance of USD 348 billion by 2030 to become climate resilient and transition to a low-carbon economy (World Bank). Domestic private climate finance remains low, contributing only ~5 per cent of total tracked finance (FCDO). Pakistan is relying on a USD 1.4 billion IMF loan under the Resilience and Sustainability Facility (RSF) to expand fiscal space, embed climate planning in public investments, and leverage private-sector capital for green projects. Despite these efforts, private investment remains insufficient and bureaucratic barriers delay access to urgently needed funds. In late 2024, the Federal Government launched the National Climate Finance Strategy (NCFS) aimed at mobilising domestic, international, and private finance for mitigation, adaptation and resilience, with a goal of bridging an estimated US$348 billion climate finance gap by 2030. Pakistan has also finalised its priority actions under the Global Shield programme to improve pre-arranged climate and disaster risk finance and insurance (CDRFI) to protect against recurrent disasters. On insurance, microinsurance for farmers has been piloted via the InsuResilience Investment Fund, offering protection for livestock in disaster events and helping prevent debt spirals among vulnerable households. A recent green financing drive of PKR 10 billion was also launched through a public-private partnership

under the National Credit Guarantee Company to provide guarantees, hybrid loans and equity for green projects, especially those led by youth and women.

Recommendations

In Punjab, the provincial government should pilot green bond instruments to finance low-carbon infrastructure (such as energy efficient buildings, water management and public transport), and partner with development banks or guarantee funds to de-risk investments and attract private sector participation, especially for projects in peri-urban and rural districts.

Sindh must expand insurance access for smallholder farmers and vulnerable households by implementing climate risk microinsurance schemes, indexing disaster risk triggers to satellite/weather data, and incorporating insurance costs into agricultural credit programmes to reduce post-disaster debt for rural communities.

Khyber Pakhtunkhwa should build capacity at the provincial finance and planning departments to appraise climate risk in project pipelines, integrate climate risk disclosure for large infrastructure contracts, and establish incentives (such as tax breaks or subsidies) for private sector companies that issue green or sustainability-linked financial products.

In Balochistan, where risks from drought, floods, and climate instability are high, the government should support community-level climate resilient infrastructure projects through blended finance (public + private) with partial subsidies, ensure insurance coverage for climate and disaster risk for households, and facilitate easier access to concessional loans for climate adaptation projects in remote areas.

Pakistan should fully operationalise the National Climate Finance Strategy by establishing clear annual targets for climate-aligned investments, defining eligibility criteria for public and private finance, and setting up a monitoring mechanism to track inflows and outcomes. Strengthening the climate finance portal to provide transparent dashboards will increase trust and attract private investors.

Globally, Climate finance flows need to increase at least fivefold, reaching USD 7.5 trillion per year by 2030 and over USD 8.8 trillion per year from 2031–2050, with a stronger focus on adaptation finance (CRI). Prioritise grant-based financing over loans to avoid deepening debt crises and ensure funding reaches low-income communities (OXFAM). COP30 should emphasise the establishment or scaling of multilateral de-risking facilities, technical assistance for carbon accounting, climate risk disclosure standards, and robust insurance mechanisms like Global Shield or equivalent to ensure that countries like Pakistan can access rapid finance in disasters without increasing debt burdens.

Pakistan must pursue a judicious mix of domestic resources and external financing provided on concessional terms, ensuring that such support does not exacerbate the country's debt burden.Given that this challenge is shared by most climate-vulnerable developing countries, Pakistan should actively collaborate with G77 member states to advocate for the inclusion of grants and concessional finance as an essential component of the global adaptation framework. Without such a proactive and coordinated approach, Pakistan risks recurrent losses from climate-induced disasters and diminishing international support for its resilience and adaptation agenda.

6.2 Finance for adaptation

Global and COP30 Context

Adaptation, as defined by the IPCC, is the process of adjusting to current or future climate impacts to avoid or minimise harm and take advantage of potential opportunities (UNEP). However, adaptation options are increasingly constrained with rising temperatures. Beyond 1.5°C warming, small islands, glacier-fed regions, coral reefs, coastal wetlands, rainforests, and polar and mountain ecosystems may reach hard limits where adaptation is no longer feasible. Avoiding maladaptation requires flexible, inclusive, multi-sectoral, and long-term planning that incorporates nature-based and equity-focused solutions (IPCC).

COP29 and preceding COPs highlighted the ongoing gaps in global adaptation finance. Despite commitments, adaptation remains underfunded globally, with finance overwhelmingly directed toward mitigation. Multilateral development banks (MDBs) have reduced grant-based financing, and new tools, like the IMF's Catastrophe Containment and Relief Trust, remain largely inaccessible for middle-income countries. Loss and Damage financing has grown, with the COP28-established Loss and Damage Fund operationalised immediately, securing over $700 million in initial commitments (UNFCCC).

Pakistan's Progress and Challenges

In Pakistan, adaptation finance is limited. Recent statements suggest that Pakistan requires between US$40-50 billion annually to meet its combined adaptation and mitigation needs, while international inflows for climate finance remain at around US$1.5-2 billion, leaving a wide shortfall. Only Rs85.43 billion has been earmarked, and budget cuts have restricted resources for implementing donor-funded adaptation projects. The government introduced Climate Budget Tagging (CBT) under the IMF Resilience and Sustainability Facility (RSF), which classifies climate-sensitive expenditures according to the National Climate Change Policy (Dawn). At the federal level Pakistan has launched the Challenge Fund for Climate Resilient Infrastructure in early 2025 under the Pak-German Climate & Energy Partnership (PGCEP) to support implementation of the National Adaptation Plan (NAP) through GIZ and Adam Smith International (ASI). Despite Pakistan's leadership as Chair of the G-77 & China in COP-27 and its advocacy for the Loss and Damage Fund, challenges persist in accessing timely and flexible financing (TheNews). Scaling innovative financial instruments, such as venture accelerator funds and blended finance mechanisms, remains critical for enabling climate-resilient investments in the country.

Recommendations

In Punjab province, the government should prioritize adaptation finance for flood mitigation infrastructure such as improved drainage, early warning systems and rehabilitated embankments, while also ensuring that agricultural subsidies and extension services are aligned with climate resilient cropping and soil management; establishing a provincial adaptation financing window could ensure quicker and more localised responses.

Sindh must channel adaptation funding toward coastal protection, mangrove restoration, and salt intrusion control so communities facing salinity and flooding are protected, and adapt-agriculture measures for small farmers should be supported through accessible grants and microfinance rather than mainly loan-based funding.

Khyber Pakhtunkhwa should direct finance to disaster risk management systems in mountainous regions, invest in glacial lake monitoring and early warning, upgrade water harvesting systems, and ensure that displaced populations and remote communities are covered by adaptation insurance or safety net programmes.

In Balochistan, where droughts and water scarcity are frequent, adaptation finance should support solar-powered water infrastructure, resilient small-scale irrigation, drought forecasting, and livelihood diversification, with particular attention to ensuring funds reach remote areas and that projects are community managed and locally maintained.

At the national level, Pakistan should adopt a national adaptation finance strategy that sets clear adaptation financing targets, tracks both domestic and international flows, prioritises grants and non-debt instruments, builds capacity for absorbing adaptation finance especially at provincial and district levels, enhances coordination across the Climate Change Authority, Planning Commission, Finance Ministry and provinces, and leverages private sector and blended finance to complement public grants.

Pakistan should scale up its Challenge Fund for Climate Resilient Infrastructure by ensuring timely disbursement procedures, simplifying fiduciary and regulatory requirements, and dedicating portions of the fund for the poorest districts in flood, drought, and glacial risk zones; this will help translate policy into local adaptation projects and build community resilience.

Internationally, COP30 should secure commitments from developed countries to scale up adaptation grant finance, streamline access for vulnerable countries, expand the Loss and Damage Fund or similar mechanisms to include adaptation components, and support technical assistance for preparing bankable adaptation projects, capacity building and local ownership of adaptation investments.

6.3 Climate-integrated public procurement

Global and COP30 Context

Public procurement, which represents up to 15-20 per cent of GDP in many countries, is being recognised as a powerful lever for climate action. In OECD countries, it accounts for around 12 per cent of national GDP and 29 per cent of total government expenditure, approximately €6 trillion per year. Globally, public procurement is responsible for an estimated 15 per cent of greenhouse gas (GHG) emissions, roughly 7.5 billion tons per year, equivalent to 8–9 times the emissions from the entire aviation industry (Nature).

COP21 reaffirmed the role of public procurement in achieving climate and environmental objectives, aligned with the Paris Agreement and the 2030 UN Agenda for Sustainable Development (OCED). The One Planet Network's Construction and Climate factsheet highlights how cities and governments increasingly use procurement to drive sustainable construction and built environment practices. Globally, while governments spend over $10 trillion annually on goods and services, political decisions and public procurement frameworks have so far fallen short of reducing GHG emissions in line with COP commitments and Nationally Determined Contributions (NDCs) (WEF; Nature).

Pakistan's Progress and Challenges

In Pakistan, procurement rules are legally regulated by PPRA (Public Procurement Regulatory Authority) and provincial PPRA bodies. Currently, full climate integration in procurement remains nascent. Balochistan's 2024 Climate Change Policy explicitly calls for green procurement principles, developing guidelines, environmental/lifecycle product standards, and requiring energy-efficient and eco-friendly products. Pakistan has mobilized over USD 1.5 billion in climate finance to address environmental degradation and enhance resilience (Pakistan Economic Survey 2024–25). The Public Procurement Regulatory Authority Rules (PPRA) 2004 Rule 7 mandates the use of Integrity Pacts for contracts exceeding Rs. 10 million (approx. USD 35,000), ensuring transparency and minimising corruption (Transparency Org). The PPRA is also working on a full overhaul of procurement rules (draft Public Procurement Rules 2025) to align them with international best practices, which could enable climate criteria to be more systematically integrated.

Despite these measures, challenges persist: procurement processes are often decentralized, governance vulnerabilities hinder the effective management of climate finance, and climate-related criteria are rarely embedded systematically in procurement practices. There are episodes of improperly conducted procurement in climate-sensitive projects, such as complaints by Transparency International about lack

of clarity, vague scopes and missing evaluation criteria in tenders for storm-water/storm drainage works in Karachi. Even projects with climate mitigation or adaptation goals often fail to incorporate operational climate criteria, limiting their effectiveness (Nature). Creating a "whole-of-society" approach and building public trust remain ongoing challenges for climate-integrated procurement in Pakistan (Transparency Org).

Recommendations

Punjab should develop a provincial green procurement policy that mandates inclusion of energy efficiency, environmental certification, and carbon/lifecycle cost criteria in all tenders for public buildings, vehicles, and equipment, and pilot tenders that reward low-carbon bids even if their initial cost is higher. Training procurement officers in Punjab PPRA in green product assessment and lifecycle cost analysis will help build capacity. Sindh needs to revise its procurement guidance to include required environment-friendly standards for materials used in infrastructure works, require contractors to quantify carbon emissions in bids, and enforce evaluation criteria that favour eco-friendly, recyclable, or low-emission inputs for roads, drainage, solid waste and public works projects.

Khyber Pakhtunkhwa should ensure that the PPRA-KP and provincial finance & planning departments adopt procurement specifications that favour renewables-compatible equipment, solar powered utilities and efficient appliances when contracting public institutions, schools, and hospitals; also implement auditing of procured goods for environmental compliance post-delivery to avoid misuse or procurement of substandard goods. Balochistan should operationalize the green procurement provisions of its Climate Change Policy by establishing standard guidelines for eco-friendly goods and services and by issuing procurement contracts that require environmental lifecycle assessment (including supply chain emissions), giving preference to vendors with ISO or equivalent certification, especially for remote area projects where transport and embodied carbon are high.

At national level, Pakistan should finalize and adopt the revised Public Procurement Rules 2025 with explicit climate integration—such as including environmental criteria, energy efficiency, lifecycle emissions, supplier environmental compliance and sustainability in evaluation frameworks—and ensure coordination among PPRA, Climate Change Authority, Finance Ministry and provinces. A national catalogue of green products and services with standardized specifications should be established to simplify green procurement processes and reduce price premium.

Internationally, Governments should align standards, share data across agencies, and coordinate policies to overcome decentralisation, enabling holistic implementation of climate-integrated procurement (WEF). COP30 should encourage donor agencies and climate finance institutions to require climate-

integrated procurement in funding conditions for grants or loans supporting infrastructure, public works, and disaster relief, and provide technical assistance and funding to help low- and middle-income countries like Pakistan build capacity for green product certification, lifecycle cost assessment, and monitoring of procurement environmental performance. Adaptable procurement policies are needed to support long-term supplier relationships, innovation, and evolving market dynamics. Support from organisations such as the World Bank and OECD can help integrate sustainability criteria and strengthen partnerships with green suppliers

6.4 Harmonization of carbon markets and carbon accounting standards

Global and COP30 Context

COP29 reached a landmark agreement on the rules for international carbon trading under Article 6.2 of the Paris Agreement. The agreement clarifies how countries will authorise the trade of carbon credits and how registries tracking these credits will operate. Importantly, the rules include technical reviews to ensure environmental integrity through transparent processes (UNFCCC).

Globally, international carbon markets are still evolving. Robust systems for cross-border trading, credible accounting, and verification of carbon credits remain under development. The Integrity Council for the Voluntary Carbon Market has published Core Carbon Principles to lift baseline quality in voluntary credits, and voluntary market initiatives are updating claims guidance and access toolkits to help countries capture sustainable development benefits. Major technical harmonisation work is underway to unify reporting norms: global accounting frameworks such as the GHG Protocol and ISO series are coordinating to reduce divergence in organisational and product-level accounting, which would simplify compliance, reporting and investor due diligence. COP30 provides an opportunity to translate these standard workstreams into interoperable rules that link Article 6 transfers, high-integrity voluntary credits, and transparent national inventories. Technical issues related to environmental integrity, double counting, and standardisation of methodologies need resolution to operationalise a truly effective international carbon market (TheNews).

Pakistan's Progress and Challenges

Pakistan has made strides in piloting voluntary carbon markets. The Sindh government's Delta Blue Carbon Project aims to restore 350,000 hectares of mangroves, potentially reducing 27 million tonnes of CO2-equivalent emissions over the project's lifecycle. A carbon and nature registry has been initiated with the World Bank to better leverage carbon markets. In addition, the Ministry of Climate Change (MoCC) partnered with VerraStandards, the world's most widely used greenhouse gas (GHG) crediting programme, signing a collaboration to share knowledge on carbon markets and the carbon credit certification process (TheNews).

However, significant challenges remain. The implementation of registries, identification of additional sectors such as waste for carbon monetization, and exploration of carbon taxation and emission caps are still in early stages. Nevertheless, gaps persist: regulatory frameworks for rigorous MRV and registry interoperability are nascent, domestic capacity for issuing sovereign or host-country credits is limited,

methodologies for additionality and baseline setting need strengthening, and safeguards are required to ensure benefits flow to local communities rather than only to external buyers. Transparent accounting and a clear approach to how any traded units affect Pakistan's NDCs will be essential as markets scale. Pakistan, like the global community, faces the need to operationalise robust accounting standards to ensure transparency, credibility, and environmental integrity in carbon trading (TheNews).

Recommendations

Sindh should focus on developing high-quality nature-based projects such as mangrove restoration and coastal blue carbon that use standardized methodologies and community benefit agreements, and ensure project design documents include robust baseline, additionality, and co-benefit monitoring to attract premium buyers while protecting local livelihoods. Punjab can pilot industrial decarbonisation cluster credits by aggregating efficiency upgrades across small and medium enterprises with a common MRV protocol, allowing cost-effective issuance while building provincial capacity in measurement, reporting and verification and demonstrating a template for scaled Article 6 cooperation.

Khyber Pakhtunkhwa should prioritise clean cookstove and small hydro aggregation projects that serve remote communities, pair project issuance with clear safeguarding and benefit sharing, and use national readiness support to make these projects compatible with international buyer requirements. Balochistan should use blended finance and technical assistance to develop pilot projects for coastal and rangeland carbon sequestration with conservative emission reduction estimates and community ownership clauses, while the federal government ensures registry interoperability and clear guidance on how issued units affect Pakistan's NDC accounting.

Pakistan should finalise a clear national carbon market strategy that distinguishes between units used for domestic compliance, Article 6 cooperative approaches, and voluntary market supply, and should publish a registry roadmap and MRV standards that align with international good practice so that credits issued from Pakistan are credible and compatible with Article 6 accounting.

At the global level, countries should agree under COP30 to adopt interoperable accounting systems that align Article 6 reporting, voluntary market registries, and corporate GHG disclosures through shared data formats and cross-referencing protocols. Developed countries should commit to capacity-building and technology transfer to help developing nations establish high-integrity registries and MRV systems. International finance institutions should embed carbon accounting standards into investment criteria and assist with setting up national registries. Harmonisation across platforms such as ICVCM, VCMI, ISO, and the GHG Protocol should be endorsed collectively at COP30 to ensure that carbon credits traded anywhere represent real, additional, and permanent emission reductions.

6.5 Climate and trade

Global and COP30 Context

Trade is both a channel for climate risk and an engine for the low-carbon transition. Rising temperatures, sea-level rise, and extreme weather disrupt supply chains and alter comparative advantages, particularly in climate-sensitive sectors such as agriculture and manufacturing. Yet trade in environmental goods and services can accelerate decarbonisation by widening access to clean technologies and lowering costs through scale. WTO simulations suggest that eliminating tariffs and reducing non-tariff measures on energy-related environmental goods could boost exports by 5 per cent by 2030, while improving energy efficiency and lowering global emissions by 0.6 per cent, with the clean energy transition creating up to 30 million new jobs globally (WTO). However, there are deep concerns for developing countries and LDCs, which contribute minimally to global emissions yet face the highest climate-trade vulnerabilities. Of the 46 LDCs, 35 rely on commodities directly threatened by climate change for over 60 per cent of their export revenue (ODI). Emerging green trade measures such as the EU Carbon Border Adjustment Mechanism (CBAM) and US Inflation Reduction Act risk fragmenting markets and raising compliance costs for vulnerable exporters (GPJ). COP30 negotiations therefore centre on a dual imperative: harnessing trade to scale green technology, services, and resilient goods, while ensuring that new climate-aligned trade rules remain equitable through harmonised standards, transparent measures, and accessible finance and technology transfer.

Pakistan's Progress and Challenges

Pakistan's trade profile is highly climate-sensitive: agriculture and textiles (cotton and its value chains) remain critical export earners and are exposed to floods, heat, and water stress. The 2022/2023 super-floods dealt a major blow to cotton and other crops and created supply-chain shocks for textiles; rice exports have shown notable resilience and even grown in 2024–25 after India's export restrictions, but systemic vulnerability persists.

Pakistan's NDC 3.0 and National Adaptation Plan stress the need for climate-aligned industrial upgrading, green technology access, and supply-chain resilience, but implementation is constrained by limited clean-tech access, weak measurement and emissions-accounting capacity at firm level, and financing gaps for decarbonisation investments. As an LDC, Pakistan faces a particular risk: many of its export sectors could attract additional costs or non-tariff obstacles under CBAM-style regimes unless exporters can demonstrate low carbon intensity and comply with new reporting rules. Regional and multilateral pathways for capacity-building, technology transfer, and concessional finance are therefore essential if Pakistan is to protect export market share while pursuing green industrialisation

Recommendations

Prioritise developing a national exporter carbon-readiness roadmap (methodologies, default emissions factors, and sectoral guidance for textiles, cement, steel, fertilizers and rice); negotiating technical assistance and time-bound flexibilities with key partners (EU, UK, US) to prevent abrupt market exclusion as CBAM and similar regimes mature; and mobilising concessional finance and blended instruments (via MDBs / GCF) to de-risk firm-level investments in energy-efficiency and process electrification. Tie trade policy to a green competitiveness scheme that co-pays clean-tech upgrades for SMEs in export chains and mandates public procurement preference for verified low-carbon suppliers.

Punjab should launch a *Punjab Green Exports Accelerator* that bundles on-the-ground carbon auditing support (sectoral default factors for ginning, spinning, dyeing), targeted grants for energy-efficiency retrofits in the textile cluster, and a provincial low-carbon certification lab (supported by TDAP and donors). Complement finance with a "fast lane" export facilitation for certified low-carbon consignments (preferential paperwork and marketing support) to secure market access in Europe and Africa while improving domestic value-chain resilience to crop shocks. Link the programme to irrigation and climate-smart agriculture measures (NDC/NAP) to reduce upstream raw-material volatility.

Sindh should prioritise decarbonising industrial clusters in Karachi and the port hinterland: create a *Port-Linked Green Industrial Roadmap* that incentivises captive renewable power (PPAs for port-adjacent firms), industrial waste-heat recovery and shared effluent treatment to lower carbon intensity for exportable goods. Introduce export-oriented green zones where firms receive time-limited tax breaks for demonstrable emissions reductions and where CBAM-style compliance support (measurement, verification) is co-funded by provincial and donor pools. Use Karachi's logistic advantage to pilot carbon-aware shipping corridors (preferred slots or documentation support for low-carbon consignments)

KPK's recommendation is to strengthen *value-chain resilience* for agro-exports and nascent manufacturing by (a) promoting climate-smart agronomy to stabilise raw yields, (b) funding small-scale processing hubs that add value locally and reduce transport emissions, and (c) offering MSME-level technical assistance to measure embodied emissions so producers can access green premiums in regional markets. Integrate provincial trade promotion with NAP-supported adaptation finance to ensure producers can meet environmental standards without losing market access.

In Balochistan, focus on resilient, higher-value coastal and mineral exports: develop *climate-proofed logistics corridors* linking Gwadar to domestic value-addition facilities, invest in efficient cold-chains for fisheries and high-value agri-products, and pilot low-carbon processing (solar cold storage, efficient drying) funded via blended finance. Ensure mining and mineral exports comply with environmental

standards through provincial monitoring and phased decarbonisation roadmaps to avoid future trade penalties.

6.6 Reduction of non-CO_2 gases

Global and COP30 Context

The non-CO2 greenhouse gases methane (CH4), nitrous oxide (N2O) and fluorinated gases (HFCs, PFCs and SF6) contribute to about a quarter of the human-made global warming in a 100 years perspective and to close to half of the warming in the shorter timeframe of 20 years, due to the strong but short-lived warming effect of some of these gases.[179] Successful and rapid mitigation of the short-lived gases, in particular CH4 and short-lived fluorinated gases, is one of few options the World still has at hand to keep below 2 degrees warming in the next few decades.[180] Non-CO2 greenhouse gases also cause almost 500,000 deaths every year from respiratory illnesses and 5-7 percent of global crop losses at a time when global production is already strained.

Beyond their climate impacts, non-CO_2 gases also have immediate health and food security consequences, causing nearly 500,000 deaths annually from respiratory illnesses and 5–7 per cent of global crop losses at a time when global food production is already under stress.[181]

Pakistan's Progress and Challenges

Pakistan has taken several steps to reduce non-CO_2 greenhouse gases, particularly methane and nitrous oxide, through targeted policy actions and international cooperation aligned with its Updated Nationally Determined Contributions (NDCs) and the National Adaptation Plan (NAP). The country joined the Nitric Acid Climate Action Group (NACAG) to curb industrial N_2O emissions.[182] In agriculture, methane reduction efforts are being advanced under the Climate and Clean Air Coalition (CCAC) through climate-smart rice management programs that promote Alternate Wetting and Drying (AWD) irrigation and sustainable livestock manure handling to mitigate methane emissions.[183] These initiatives also align with Pakistan's National Methane Action Roadmap, which aims to develop emission inventories and strengthen institutional capacity for monitoring and reporting.[184]

[179] https://iiasa.ac.at/themes/non-co2-greenhouse-gas-sources
[180] https://iiasa.ac.at/themes/non-co2-greenhouse-gas-sources
[181] https://2021-2025.state.gov/accelerating-fast-mitigation-summit-on-methane-and-non-co2-greenhouse-gases/
[182] https://dailytimes.com.pk/1234926/nacag-pakistan-grant-agreement-signing-to-support-implementation-of-tertiary-n2o-abatement-technology-in-pakistan-nitric-acid-industry/
[183] https://www.ccacoalition.org/projects/climate-smart-rice-management-pakistan
[184] https://www.ccacoalition.org/projects/pakistan-deliver-national-methane-action-roadmap

Recommendations

Punjab should cut agricultural methane and nitrous oxide emissions by promoting alternate wetting and drying in rice cultivation, better manure management, and precision fertilizer use in high-intensity cropping zones. These interventions can significantly reduce non-CO_2 gases while improving soil productivity and input efficiency.[185][186]

Sindh should invest in landfill-gas capture, waste-to-energy facilities, and refrigerant phase-down programmes to reduce methane and HFC emissions from its urban and industrial centres. Integrated waste management and cooling-sector reforms can deliver rapid, measurable cuts in non-CO_2 emissions.[187][188]

Balochistan should target methane reductions through improved livestock feed and manure handling, alongside pilot projects for low-emission rice and wetland management. These measures would lower emissions in pastoral and irrigated zones while supporting sustainable agricultural productivity.[189][190]

KP should expand biogas and composting programmes for livestock waste and enforce leak-detection standards for energy infrastructure to minimise fugitive methane. Small-scale renewable gas projects can simultaneously improve rural energy access and reduce greenhouse emissions.[191][192]

Reducing methane emissions requires a mix of technological solutions and systemic changes to practices and behaviors. Systemic changes include reducing livestock numbers through improved productivity and dietary shifts towards plant-based foods; reducing emissions from livestock; using rice cultivars with lower methane emissions; improving water and fertilizer management in rice cultivation. Policy measures for methane abatement include emission reduction targets, enforceable regulations, and financial incentives such as subsidies and methane pricing.[193]

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[185] https://epd.punjab.gov.pk/system/files/Climate%20Resilient%20Punjab%20Vision%20&%20Action%20Plan%202024.pdf
[186] https://openknowledge.worldbank.org/handle/10986/35437
[187] https://transparency.org.pk/Climate-change-Policies/Sindh-Climate-Change-Policy-2022-(Final).pdf
[188] https://unfccc.int/sites/default/files/2025-09/Pakistan_NDC3.0_24%20Sep.pdf
[189] https://www.undp.org/sites/g/files/zskgke326/files/2024-11/bccp_report.pdf
[190] https://openknowledge.fao.org/handle/20.500.12672/11029; https://documents.worldbank.org/en/publication/documents-reports/documentdetail/106605-WP-Greenhouse-P132432-PUBLIC.pdf
[191] https://unfccc.int/sites/default/files/2025-09/Pakistan_NDC3.0_24%20Sep.pdf
[192] https://epakp.gov.pk/wp-content/uploads/2022/09/Khyber-Pakhtunkhwa-Climate-Change-Policy-2022
[193] https://www.ccacoalition.org/news/three-actions-and-tool-cut-methane-emissions-and-slow-global-warming#:~:text=Systemic%20changes%20include%20reducing%20livestock,reliance%20on%20carbon%20removal%20technologies.

6.7 Governance, state capacities and institutional strengthening for climate action, planning and preparedness

Global and COP30 Context

Effective climate action requires strong governance, capable institutions, and well-coordinated planning at all levels. Vertical climate and environmental funds (VCEFs), multilateral development banks (MDBs), national development banks (NDBs), and the broader ecosystem of public development banks (PDBs) play key roles in supporting climate and development objectives. However, these institutions differ significantly in size, governance, mandates, and operations, leading to fragmented approaches and data gaps. Harmonization of methodologies for tracking co-financing, mobilisation, and reporting remains a critical global challenge (Climate Policy Initiative). The concept of Internationally Determined Contributions (IDCs) has been proposed to enhance global accountability, complementing Nationally Determined Contributions (NDCs) by requiring developed countries to make measurable commitments to finance and support climate action in developing nations (The Guardian).

Pakistan's Progress and Challenges

Pakistan has strengthened its climate governance and institutional capacity through national and provincial frameworks aimed at improving climate action, planning, and preparedness. The Pakistan Climate Change Act (2017) established the Pakistan Climate Change Council and Authority, formalizing a national structure for implementing climate policy and coordinating adaptation and mitigation efforts across sectors. Punjab, Sindh, Khyber Pakhtunkhwa, and Balochistan has introduced its own provincial climate change policy to localize adaptation strategies, improve resilience, and mainstream climate considerations into development planning. These frameworks are supported by the National Adaptation Plan (NAP) and Updated NDCs, which aim to enhance coordination, financing, and technical capacity for climate preparedness nationwide.

Despite these advances, Pakistan continues to face serious governance and capacity challenges that undermine climate planning and preparedness. The 2025 floods highlighted weaknesses in coordination, early warning response, and institutional readiness across federal, provincial, and district levels, exposing gaps between policy and execution.[194] Many provincial governments struggle with low implementation capacity, as evidenced by limited spending of climate allocations—Sindh, for instance, has utilized less than half of its approved climate budget in recent years due to staffing shortages and

[194] https://cdpr.org.pk/climate-priorities-lessons-for-flood-risk-mitigation-in-pakistan/

administrative inefficiencies. Institutional fragmentation, overlapping mandates between federal ministries and provincial authorities, and insufficient vertical coordination continue to constrain effective climate governance (The Knowledge Forum, 2024). Strengthening Pakistan's climate governance will require clearer mandates, consistent financing, inter-agency coordination, and stronger preparedness mechanisms to ensure timely and coherent responses to future climate shocks (CDPR, 2025).

Recommendations

Punjab should establish a dedicated Climate Coordination Unit with authority to harmonise sectoral actions, monitor progress, and integrate adaptation and mitigation priorities across departments. Centralised governance and digital monitoring would ensure faster implementation and accountability.[195]

Sindh should create a climate-finance and project-pipeline unit to prepare bankable projects, attract green investments, and coordinate with federal agencies for funding. Streamlined governance and stronger technical capacity would accelerate adaptation and mitigation delivery in priority sectors.[196]

Balochistan should strengthen its environmental and energy departments through new technical cadres, structured data sharing with national utilities, and clear disaster-response protocols. Enhanced institutional capacity would improve climate planning, emergency coordination, and project execution across the province.[197]

KP should operationalise district-level climate cells linked to provincial planning and integrate climate screening into public procurement and infrastructure projects. Building technical capacity at local levels will mainstream resilience into routine governance and service delivery.[198]

Strengthen disaster management institutions and improve coordination across federal, provincial, and district levels. The National Disaster Management Authority, provincial disaster management authorities, and district disaster management authorities lack coordination, clear mandates, and

195 https://epd.punjab.gov.pk/system/files/Climate%20Resilient%20Punjab%20Vision%20&%20Action%20Plan%202024.pdf

196 https://transparency.org.pk/Climate-change-Policies/Sindh-Climate-Change-Policy-2022-(Final).pdf

197 https://www.undp.org/sites/g/files/zskgke326/files/2024-11/bccp_report.pdf

198 https://epakp.gov.pk/wp-content/uploads/2022/09/Khyber-Pakhtunkhwa-Climate-Change-Policy-2022.pdf

adequate resources. This fragmentation debilitates early warning dissemination and disrupts effective evacuation, particularly in rural areas where flood impacts are most severe.[199]

Vertical climate and environmental funds (VCEFs), multilateral development banks (MDBs), national development banks (NDBs), and the broader ecosystem of public development banks (PDBs) all contribute to development and climate goals, but differ significantly in their size, governance, mandates, and operations. Institutions differ in their definitions of co-financing and of mobilization, demonstrating the need for harmonization in tracking methodologies. Data gaps and inconsistent reporting limit a full analysis of co-financing between VCEFs, MDBs and NDBs.[200]

[199] https://www.thefridaytimes.com/03-Sep-2025/pakistan-s-paradox-of-floods-and-water-shortage
[200] https://www.climatepolicyinitiative.org/publication/strengthening-collaboration-to-scale-climate-and-development-finance/

6.8 Artificial Intelligence, Digital Public Infrastructure and Digital Technologies

Global and COP30 Context

Artificial Intelligence (AI) is increasingly recognised as a powerful tool for enabling climate action, particularly in developing countries that are most vulnerable to climate impacts. While AI systems, especially those using deep learning and large language models (LLMs), are highly energy intensive, their current contribution to global GHG emissions remains minimal, at around 0.01 per cent, and even rapid growth is not expected to significantly increase emissions in the near term (Nature). Data centre operations already account for approximately 0.6 per cent of global emissions, and AI infrastructure requires substantial quantities of water for cooling. Estimates suggest water consumption by AI could reach 6.6 billion m^3 by 2027, with local impacts particularly acute in water-scarce communities (IEA; OECD; UNFCCC). COP29 discussions highlighted the potential of AI and other digital technologies in improving climate modelling, disaster preparedness, and resilience planning, underscoring the need for robust digital public infrastructure to strengthen adaptation strategies and enable evidence-based policymaking.

Pakistan's Progress and Challenges

Pakistan has made notable progress in advancing Artificial Intelligence (AI), Digital Public Infrastructure (DPI), and digital technologies, positioning these tools as catalysts for economic transformation and improved governance. The National Artificial Intelligence Policy 2025 lays out a comprehensive framework to train one million AI professionals by 2030, foster innovation through AI venture funds, and enable the development of 1,000 indigenous AI products and 50,000 civic technology projects (Aaj News, 2025). The policy emphasizes inclusivity by supporting women, youth, and people with disabilities, as well as integrating AI literacy into public sector capacity building to enhance digital governance (The Nation, 2025). In parallel, the government has initiated measures to strengthen digital infrastructure, including the allocation of 2,000 megawatts of surplus electricity to power AI data centers and emerging digital industries, signaling a shift toward an innovation-driven economy (Reuters, 2025). Research and innovation are also expanding, as seen in projects like AI-based mapping of brick kilns in the Indus-Gangetic Plain, which support evidence-based environmental policymaking (arXiv, 2024).

Despite this progress, Pakistan faces persistent infrastructure, governance, and equity challenges in realizing the full potential of AI and digital transformation. The digital divide between provinces, unreliable internet connectivity, and limited data security and privacy regulations constrain nationwide implementation of DPI frameworks (Reuters, 2025). Additionally, while the 2025 floods highlighted

how AI could improve disaster forecasting and response, the lack of integration between digital systems and climate governance institutions limits their operational effectiveness (The Nation, 2025). To ensure sustainable outcomes, Pakistan must prioritize governance reform, equitable access, and institutional capacity-building, ensuring that digital tools are ethically deployed and aligned with national priorities such as climate resilience, education, and public service delivery (Aaj News, 2025).

Recommendations

Punjab should develop integrated digital platforms for climate data, smart irrigation, and flood forecasting, using AI to support real-time decision-making and early warnings. Linking these systems with provincial disaster and agriculture departments would enhance preparedness and resource efficiency.[201]

Sindh should deploy interoperable digital infrastructure to monitor coastal and marine ecosystems and apply AI for early detection of illegal fishing and salinity intrusion. Integrating environmental sensors with restoration planning tools would strengthen adaptive coastal management[202]

Balochistan should adopt low-power satellite and IoT technologies for monitoring renewable-energy assets, groundwater, and desertification trends across remote districts. Digital systems tailored to off-grid conditions can vastly improve data accuracy and reduce maintenance costs.[203]

KP should pilot AI-enabled landslide and flood-risk mapping integrated with district-level early-warning systems and mobile alert platforms. Data-driven monitoring can reduce disaster impacts and strengthen climate preparedness in mountainous areas.[204][205]

AI-driven Earth observation and remote sensing technologies are supporting adaptation efforts in sectors like agriculture, water management and ecosystem conservation. These systems provide real-time information on soil health, water levels and land degradation, helping countries monitor environmental conditions that are critical to adaptation. By using AI systems that include satellite data, governments and communities can be supported in implementing timely interventions, adjusting farming practices and managing natural resources more effectively, supporting food security and sustainable development.[206]

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201 https://epd.punjab.gov.pk/system/files/Climate%20Resilient%20Punjab%20Vision%20&%20Action%20Plan%202024.pdf

202 https://transparency.org.pk/Climate-change-Policies/Sindh-Climate-Change-Policy-2022-(Final).pdf

203 https://www.undp.org/sites/g/files/zskgke326/files/2024-11/bccp_report.pdf

204 https://epakp.gov.pk/wp-content/uploads/2022/09/Khyber-Pakhtunkhwa-Climate-Change-Policy-2022.pdf

205 https://unfccc.int/sites/default/files/resource/National_Adaptation_Plan_Pakistan.pdf

206 https://unfccc.int/ttclear/misc_/StaticFiles/gnwoerk_static/AI4climateaction/28da5d97d7824d16b7f68a225c0e3493/a4553e8f70f74be3bc37c929b73d9974.pdf

6.9. Innovation, climate entrepreneurship and small and micro businesses

Global and COP30 Context

MSMEs (micro, small, and medium enterprises) are foundational to global economies—they account for around 90 per cent of all businesses and more than 50 per cent of employment worldwide. They also offer large potential for climate adaptation and mitigation: distributed innovators, circular production, localised renewable and energy-efficient services. COP30's Action Agenda emphasises enabling ecosystems for MSMEs to contribute to climate goals by reducing regulatory barriers, improving access to green finance, incorporating measurement and standards, and enabling technology transfer. But globally, many MSMEs struggle with inconsistent environmental standards, fragmented certification systems, and the complexity of meeting export or climate-aligned compliance, which limits scaling and investment.

Pakistan's Progress and Challenges

Pakistan has made some concrete strides toward supporting climate innovation. For instance, Climate Innovation Pakistan (CLIP) is an incubator platform aiming to transform early-stage ideas into market-ready clean energy and climate solutions, and to influence policy enabling green entrepreneurship. Also, the federal government has negotiated a Rs 10 billion green financing guarantee scheme with NCGCL to catalyze credit and equity flows to green startups. The NDC 3.0 includes a green taxonomy and efforts to deploy green finance tools (e.g. green bonds, green budget tagging) to mobilise climate-aligned capital.

But significant challenges remain. As reported in a 2025 survey, climate-adaptation venture capital in Pakistan saw a steep drop (90 per cent) from 2021 to 2024, reflecting liquidity constraints and weak investor confidence. Many MSMEs cannot meet the criteria for green credit or donor funds due to limited capacities in measurement, reporting, and compliance. Regulatory uncertainty and fragmented provincial rules deter scaling. Also, the institutional structures under NAP and CPSER have limited capacity or funding to support climate entrepreneurship at scale.

Recommendations

In Punjab, embed MSME climate entrepreneurship into the province's industrial and startup policies by designing a *Green MSME Accelerated Growth Programme* that offers bundled support: concessional finance via provincial counterpart to GIF, technical assistance for climate compliance (energy efficiency,

carbon accounting), and market linkage supports (e.g., green procurement in public contracts). Expand capacity building via universities and technical institutes in Lahore and Multan to include climate-tech skills (solar, waste recycling, efficient water tech). Use matching grants to de-risk early-stages, especially for youth- and women-led ventures. Simplify regulatory approval for climate innovation in key sectors (clean energy, circular economy) by setting up a one-window service in the provincial government.

Sindh should build on Karachi's CLIP presence and the GreenFin and Green Bond instruments by establishing climate innovation zones within Karachi and Hyderabad that bring together MSMEs, industrial estates, incubation hubs, and financing partners. Provide tailored grants/loans for climate-entrepreneurs working on waste-to-value, clean mobility, water-tech or plastics recycling, backed by regulatory incentives (tax relief, fast-tracking for environmental permits). Ensure that gender and marginalised areas are included by reserving a share of finance for women-led and informal sector innovators. Strengthen mentorship and export readiness programmes aligned with green standards so local MSMEs can integrate into international climate supply chains.

For KPK, focus support on rural and mountainous MSMEs: expand mobile/incubator outreach via CLIP's network to districts like Peshawar, Swat, Abbottabad, offering climate-tech bootcamps and site-based pilot support (e.g. renewable energy off-grid solutions, climate-resilient agri-inputs). Provide risk guarantees and concessional loans through local credit guarantee schemes to reduce barriers to finance for climate entrepreneurs in remote areas. Promote partnerships with local universities to convert local resource and biodiversity into marketable climate products (e.g. herbal, bio-inputs, eco-tourism services) under technical support. Ensure provincial regulations support innovation (clear patent/IP, biosafety, permits) to reduce friction for startups.

Given remoteness and low infrastructure in Balochistan, support small scale green innovation pilot schemes in coastal, arid, and rural settings: for example solar powered cold-storage, desalination or brackish water treatment, and waste upcycling. Mobilise the federal GIF and GreenFin Innovations to provide seed grants + technical assistance in Quetta, Gwadar and other district centers. Facilitate startup mentorship and market access through partnerships with national incubators (CLIP) and private sector. Use the Sustainable Financing Framework (SFF) to mobilise green bonds / social bonds that include MSME climate innovation projects in Balochistan. Simplify permit and regulatory requirements for green innovation to reduce costs and delay.

6.10. Bioeconomy and biotechnology

Global and COP30 Context

The global market for bio-based food, feed, products, and energy is projected to grow from USD 10.3 trillion in 2018 to USD 12.8 trillion in 2030, representing an annual growth of 1.8 per cent. The biomass required to sustain this growth is expected to increase from 23.4 billion tonnes in 2018 to 26.7 billion tonnes by 2030 (WBCSD). Bio-based products and energy, excluding food and feed, are expected to grow at a faster rate of 2.4 per cent per year, reaching USD 7.7 trillion by 2030, with the segment of bio-based products and energy alone projected to grow from USD 3.4 trillion in 2018 to USD 5 trillion in 2030 (WBCSD). This market segment offers the largest potential for substitution and complementation within the circular bioeconomy. Despite these opportunities, the sector has not yet scaled sufficiently to achieve meaningful environmental or economic impact. Under COP30, bioeconomy is emerging as a key cross-sectoral lever: integrating agriculture, industry, waste, and energy to reduce emissions, build resilience, and generate inclusive economic opportunity. Critical enablers recognised globally include robust regulatory regimes, investment in R&D, biosafety and biosecurity assurances, market readiness including consumer acceptance, and policies for sustainable biomass sourcing.

Pakistan's Progress and Challenges

Pakistan has begun laying institutional foundations for bioeconomy and biotechnology: there is a finalized National Biotechnology Policy pending cabinet approval (August 2025) addressing seed/genetics, GMOs, research & development constraints. The Pak-Biosafety Clearing House (Pak-BCH), and the amended National Biosafety Rules & Guidelines (2005, amended 2024) provide frameworks for biosafety oversight, import/export, field trials, Institutional Biosafety Committees (IBCs), etc. The Joint Center for Bioeconomy (Peshawar) maps policy & capacity gaps, highlighting Pakistan's weak data, limited human resource in advanced biotech (synthetic biology, computational biology) and low consumer awareness. Also, the National Circular Economy Policy process (2025) includes references to bio-based materials and bioeconomy as part of sustainable industrial practices.

However, despite policy commitments in NDC 3.0 to boost clean innovation and technology in agriculture and industry, real uptake remains constrained. Regulatory delays for biotech import permits, restrictive policies around GMOs, lack of risk-based streamlined biosafety approvals, inadequate funding for biotech R&D, and low levels of private investment or public awareness all hamper scale. There is also a mismatch between resource capacity and market demand: bio-based plastics innovations exist (e.g. biodegradable plastics from agricultural waste), but these are early stage, small scale, costly, and have not yet penetrated mainstream market nor been incorporated into national emission reduction modelling.

Recommendations

Punjab: Leverage the province's agricultural output to pilot biomass conversion (straw, sugar-cane bagasse) into bio-based plastics or bioenergy in Punjab's agro-industrial zones; support research institutions (e.g. UVAS, Lahore) to partner with innovators; build provincial regulation to allow field trials of genetically improved seed varieties under strict biosafety oversight.

Sindh: Promote biotech in fisheries, marine algae, and coastal biomass (e.g. mangrove waste) for blue bioeconomy products; streamline coastal zone biotech research; support industrial biotech parks in Karachi with incentives; ensure local regulation supports safe use of GMOs and public communication to build acceptance.

Khyber Pakhtunkhwa (KPK): Expand bioscience capacity (labs, computational biology, synthetic biology) via local universities; integrate biotechnology into livestock/dairy improvement programs; use indigenous plant species for value-added bio-products; provide outreach and extension to farmers on biofertilizers, biopesticides under KPK's agricultural initiatives.

Balochistan: Support biotechnology solutions in arid & coastal zones: salt-tolerant crop bioengineering, bioremediation of saline soils, bioenergy from biomass/seaweed; build small-scale demonstration projects and local industry for bio-inputs; include Balochistan in federal biotech R&D grants to reduce regional disparities.

Strengthen regulatory systems (Pak-BCH, IBCs) for transparency and speed; unlock private finance via public-private partnerships; invest in public awareness campaigns to build market for bio-based products; integrate bioeconomy targets into future NDC/CPSER updates with measurable metrics, usch as percentage of bio-based inputs, biotech R&D expenditure, and emission savings.

Assess initial investment needs against long-term savings and risk reduction. Evaluate both additional or upfront costs and potential cost-saving opportunities to support the adoption of circular bio-based solutions (WBCSD). Prioritise technological solutions as central to bioeconomy transformation. Integrate emerging technologies into corporate and national strategies to tackle potential hurdles and drive systemic change (WBCSD).

Policy and Regulation: Advocate for supportive public policies, subsidies, or taxation measures to stimulate the utilisation of bio-based materials and reduce carbon footprints. Public support can help overcome barriers related to investment costs or adoption challenges.Educate consumers on the quality, sustainability, and long-term benefits of bio-based products. Enhance perceived value to encourage acceptance and willingness to pay a premium for sustainable alternatives (WBCSD).

6.11 Information Integrity in Climate Change Matters

Global and COP30 Context

Misinformation and disinformation are now recognised as systemic risks to climate action: the World Economic Forum's Global Risks Report 2024 ranked disinformation among the top short-term global threats, while extreme weather was the top long-term risk — a dangerous combination that undermines preparedness and public support for adaptation/mitigation. COP30 explicitly emphasises information integrity as essential to translating global commitments into local action: accurate, timely climate information underpins early warning systems, risk-aware planning, and behaviour change (prevention, preparedness, uptake of resilient practices). Key international guidance calls for a three-part approach: (a) strengthen trustworthy public science communication and media literacy, (b) require corporate transparency for platform amplification and AI systems, and (c) scale pre-bunking and fact-checking interventions that build community resilience to false narratives

Pakistan's Progress and Challenges

Public awareness in Pakistan is mixed and stratified by education: surveys show only 47 per cent of illiterate respondents accept that warming is anthropogenic versus 60 per cent among the highest-educated groups, and trust in science and media is low, journalists report weak, sporadic climate coverage and limited fact-checking capacity. Disinformation often fills the vacuum where trusted, localised climate information is absent. At the institutional level, Pakistan's NAP (2023) and NDC 3.0 (2025) call for strengthened climate communication, education, and community engagement, but implementation gaps persist: coordination between MoCC, provincial departments, meteorological services (PMD), and civil society is uneven, and the CPEIR/CPSER analysis shows public spending and capacity for outreach and digital resilience remain inadequate. The rise of AI and cheap synthetic content increases the risk of fast-spreading false climate narratives unless transparency, platform accountability and pre-emptive education are scaled up.

Recommendations

Create a National Information Integrity & Climate Communication Strategy (MoCC lead, with MoIB/PMD/APTI) that funds localised climate reporting, integrates PMD forecasts with verified public messaging, mandates transparency reporting by large platforms operating in Pakistan, and establishes a rapid response fact-check cell for climate/early-warning misinformation.

Punjab: Fund school and adult media-literacy curricula tied to provincial disaster risk reduction (DRR) programmes; establish a Lahore Climate Media Hub that trains journalists in data-driven climate reporting, hosts pre-bunking campaigns before monsoon seasons, and publishes an open data portal (PMD + Irrigation telemetry) to reduce rumor gaps.

Sindh: Build a Karachi public-interest climate desk (in partnership with local universities and broadcasters) to translate technical PMD/NDMA warnings into Sindhi/Urdu radio and SMS alerts for informal settlements; pair this with community pre-bunking workshops and women-led local info networks to counter localized misinformation.

Khyber Pakhtunkhwa (KPK): Sponsor district-level early-warning liaison officers who receive verified hydro-meteorological briefings (PMD/IRSA) and coordinate mobile outreach (radio, mosque announcements, school networks) for flash floods and landslides; train local journalists in responsible reporting on disasters and climate science

Balochistan: Prioritise low-bandwidth, community-trusted channels (radio, local councils) and produce visual/audio prebunking material in local languages about flood/drought risks and safe responses; couple with mobile verification training for provincial health and disaster staff so official messages are amplified in remote areas.

Cross-cutting actions: (a) Fund civil-society fact-checking networks and university hubs to run pre-bunking 'inoculation' pilots before high-risk seasons (evidence shows prebunking reduces susceptibility). (b) Require AI transparency: public disclosure of synthetic-content use in official campaigns and adopt UN guidance on safe, rights-respecting AI governance. (c) Make climate communication an eligible item in adaptation finance and provincial CPSER/CPEIR planning so messaging capacity is sustainably funded.

Collaborate with independent, third-party organizations to conduct regular human rights risk assessments covering products, services, advertising, content moderation, and transparency mechanisms. Commission external audits to proactively mitigate societal risks (UN). Complement fact-checking with pre-bunking strategies, which pre-emptively expose people to diluted forms of misinformation, fostering resilience against false information.

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