

NAVIGATING CLIMATE CHANGE CHALLENGES: A COMPREHENSIVE ANALYSIS OF PAKISTAN-CHINA COOPERATION AND SUSTAINABLE STRATEGIES

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ABSTRACT

The China-Pakistan Transportation Corridor (CPTC) has several difficulties to hit on sustainable development accompanied by natural disasters. For the evaluation of the institution's sustainability, this study proposes a localized indicator evaluation system with 27 Tier I and 8 Tier II indicators identified for 11 of the SDGs. The findings of the years 2015, 2017, and 2020 reveal that amongst the provinces, Xinjiang ranks higher in terms of SD while Khyber Pakhtunkhwa is lowest, particularly in social and environmental matrices. The findings of this study show that among all the provinces, Islamabad Capital Territory has the better performance in SDG5, SDG8, and SDG9 whereas Punjab has a better position in SDG6 and SDG11. According to the findings, it is evident that the overall levels of sustainable development have risen; however, dimensions of Social and Environmental Development in Khyber Pakhtunkhwa have deteriorated. This study highlights the necessity of increasing cooperation between China and Pakistan regarding sustainability translation under the framework of the CPEC initiative. Climate change cannot be wished away and therefore calls for structural solutions; transition to low-carbon, climate-resilient development, and policy coherence.

INTRODUCTION

The sino-Pak relationship established in 1951 is a long-lasting friendship despite diverse beliefs, cultures, and social systems (Boni, 2019). China established diplomatic ties with Pakistan in 1951 after being the first Muslim nation to admit the country in 1950. Hussain (2020) states that the two nations have a history of supporting one another on the global stage and have inked economic, diplomatic, and strategic accords. Like its northern neighboring regions, Pakistan is located in South Asia and has a history that goes back around four thousand years. According to Ali (2017), there are profound geographical and cultural ties to the Silk Road, which links Pakistan to China and other northwesterly regions.

The ancient routes, which are today called the "Crossroad to Asia," have provided a foundation for contemporary corridors that

connect the area to a larger social and political map (Ahmar, 2020). Formalized relationships replaced more casual ones when the nation-state system emerged. Pakistan-China ties were unaffected by Cold War politics, even though Pakistan was a participant in the Korean War (Allauddin, 2020). Economic and political ties between the two nations were strengthened in the 1960s when they also reached an agreement to resolve territorial disputes. The border between Pakistan and China was also settled in December 1962 when the two governments reached an agreement.

However, President Zhou Enlai's visits to Pakistan in 1964 and 1965 were part of China's attempts to end its international isolation. China's foreign ministry has stated its intention to assist Pakistan in preserving its "national independence, sovereignty, & national

integrity" and has pledged its complete support to Pakistan in its fight against unchecked Indian aggression (Boni, 2019). Economic, commercial, technological, and military cooperation between Pakistan and China surged throughout the '80s and '90s. A free trade deal in 2007 and the China-Pakistan Economic Corridor in 2015 both contributed to the strengthening of economic ties in the twenty-first century. A cordial relationship between China and Pakistan is regularly supported by Pakistan's foreign policy, which is driven by regional security architecture & economic imperatives (Hussain, 2020).

In addition, Pakistan-China relations were influenced by the 2007 Gwadar Port opening and Chinese investments in construction endeavors like the One Belt, One Road (OBOR) initiative. China's Belt and Road Initiative (BRI) highlights Pakistan's importance via its partnership with Pakistan on the China-Pakistan Economic Corridor (CPEC), its prime project. A watershed moment in Pakistan-China relations occurred in 2015 with the inauguration of the China-Pakistan Economic Corridor (CPEC) by Chinese President Xi Jinping (Wolf, 2020). At present, the two countries' commerce is over \$9.2 billion. China has invested in energy-related projects, including a coal-fired plant with a 1,320 MW capacity in Sahiwal, a wind power facility close to Karachi for \$130 million, and two nuclear power facilities with a capacity of 1,100 MW each (Faisal, 2020).

Regardless, terrible weather patterns have been occurring in Pakistan and China for some time now. To combat the terrible environmental circumstances, however, the two nations are engaging in separate projects, initiatives, or agreements on a bilateral basis (Razzaq, 2023). On the one hand, making incentives for rapid emissions reductions is a problem for China, the world's second-largest producer of greenhouse gases. International accords and other steps taken after Kyoto may be required, but they might not be enough. China will still take responsibility in reacting to climate change, according to Ma Kai, president of the Chinese National Development & Reform Commission, even if the country will not commit to specific objectives to reduce emissions. The world must unite to do this.

The politicization of China's climate change position by President Xi Jinping is an evaluation of the state's ability to govern (Vandenbergh, 2008). A leader in the fight against climate change, China has maintained an optimistic posture since the Paris Climate Conference. Achieving carbon neutrality by 2060 is China's stated objective, as stated at the 2020 UN General Assembly. According to the Climate Change Performance Index (Lian, 2023), China is seen as a globally responsible player for climate change governance, PEC ranked 11th. The geographic location and diversified land forms make the situation in Pakistan one of the most vulnerable in facing the magnitude of climate change unlike the situation in China. More than five thousand glaciers are found in the northern area where as in the southern region there is only a barren land. As pointed out this hydrological year the phenomenon and intensities of these severe hydrological events are on the rise; the Indus Delta thus represents a major threat to sustainable agriculture. Therefore, delegating environmental laws and protection of the natural environment as a reflection of Pakistan's climate change policies brings this country face to face with a great challenge, although Pakistan is among the five Countries most affected by climate change (Rasul, 2012).

Being a South Asian country, Pakistan faces nine major impacts of climate change such as the enhanced siltation of dam, declined yield of arable land, shifting patterns of certain plant species, invasion of seawater in the Indus Delta, health hazard, water conflict amongst riparian society, destruction of mangrove forest and Glacier shrinkage in Hindu Kush-Karakoram-Himalayas. It produces below 1 percent of greenhouse gases into the world atmosphere. (United Nations, 2023). In addition, the likelihood of floods and droughts is expected to rise, with the north experiencing heavier precipitation, the Indus River system experiencing flooding, and the south experiencing drought.

The present adaptation cost to Pakistan is estimated to be between \$7 billion and \$14 billion annually. Little indications of successful implementation on the ground and little progress in developing a framework to adapt to climate change have been found (Masud, 2023).

Due to the fast pace of climate change, climate forecasts are essential for policymaking, managing resources, economic activity, and technology innovation. Nevertheless, to foresee possible consequences on water resources, agriculture, energy, economy, health, industry, and the private sector, data about climate change is required (United Nations, 2023).

An important initiative that will help both Pakistan and China achieve sustainable growth is the China-Pakistan Economic Corridor (CPEC). Sustainable development, according to this view, is progress that satisfies present demands without jeopardizing those of future generations. It stresses the need to strike a balance between monetary, social, and environmental goals. In line with Sustainable Development Theory, the localized indicator assessment system measures the extent to which various CPEC areas attain sustainability along many aspects, including economic, social, and environmental.

It strengthens commercial ties between Islamabad and Beijing while also protecting the environment and improving infrastructure. Nevertheless, environmental issues continue. To keep the planet habitable, the two nations plan to work together on renewable energy projects. To overcome these obstacles, green investment initiatives need standards and norms. If the two nations are serious about making the CPEC project last, they need to work together on environmental issues. (According to Faisal, 2100), Even though Pakistan still relies heavily on coal power plants, CPEC has enhanced the country's energy supply and has an impact on Pakistan's foreign and domestic policy in every way imaginable. The next phase is to strengthen agricultural and light industries while establishing connections to the Chinese market (Menhas, 2019). However, with the help of China's more environmentally friendly policies, Pakistan plans to get 60% of its energy through renewable sources by 2030. Sustainable development and the eradication of global environmental crises, particularly in the Global South, may be advanced by Pakistan's participation in the Belt and Road Program (BRI). Nazir (2024) argues that to speed up the adoption of renewable energy, stakeholders must work together and share expertise. New

power plants, infrastructure, industrial zones, and high traffic are some of the environmental implications of the CPEC project. Additionally, fossil fuel usage has grown. The environment as a whole will feel the effects of these changes on farming, animals, ecosystems, biodiversity, and water and air quality.

There has to be an analysis that will include the issues of ecological security, the economic and environmental agendas of a country, and overall country's strategy. The partner should bare more environmental cost seeing that the Pakistan government has intends to embark on coal based energy projects. Anthropogenic activities associated with the project have the potential to degrade soil, spread airborne infections, cause respiratory issues, help greenhouse gas emissions, deplete natural resources, and reduce biodiversity. However, in formulating a plan for environmental protection, China and Pakistan should think about their national strategy, economic and environmental interests, and ecological security concerns (Khan, 2020). Environmental policy in China has changed as a result of global obligations. To be a respected international player and long-term partner, Pakistan should study China's environmental policy. To guarantee environmental quality for the health of residents, the Supreme Court suggested reorganizing environmental impact assessment processes. Pakistan reorganized its environmental policy in response to the Rio and Stockholm Declarations, which outline sustainable development processes to strike a balance between development initiatives and environmental preservation. Sustainable development and environmental policies are both supported by China's BRI. If China wants to earn international credibility, it must implement BRI via more accountability openness, and environmental protection policies (Butt, 2021).

CLIMATE CHANGE CHALLENGES FRONTING BY PAKISTAN AND CHINA

A worldwide problem impacting many fields, climate change has been worsened by the industrial revolution. A new technological framework, more capacity development, and sufficient financial resources are necessary to

achieve the 1.5°C and 2°C temperature rise targets set forth by the Paris Agreement (Hussain, 2019). Limiting the increase in global temperature, striving for an emission peak, and executing quick reductions are all mitigation options. Thirty to forty percent of the world's greenhouse gas emissions come from agriculture, which is highly affected by climatic and agro-environmental variables. Environmentalists are understandably worried about the effects of climate change on productivity and GDP growth (Hilmi, 2019). On a worldwide scale, natural catastrophes and insecurity in food supplies are on the rise, which threatens agricultural output and, by extension, human lives (Barua, 2018). While climate change is an international problem, the China-Pakistan Economic Corridor is helping to alleviate some of Pakistan's climate-related worries. A significant contributor to ozone depletion, the energy projects of CPEC generate tons of CO₂ every day (Liang, 2018). As per the worldwide index. In the last ten years, Pakistan has seen a rise in temperatures, a decrease in biodiversity, heat waves, floods, and the melting of glaciers (Ali, et al. 2019). Progress in the economy that comes at the expense of the environment is not a good fit. According to Ali (2023), Pakistan should prioritize protecting its environment and natural resources. To lessen the negative effects of climate change, people must adapt by changing their social, economic, and environmental behaviors, but to lessen the severity of the problem, people must reduce emissions of greenhouse gases. This theory establishes the importance of topics such as adaptation to the consequences of climate change while at the same time calling for reduction in emissions, and it is on this basis that the research employs the CPTC framework in analyzing various strategies (IPCC, 2014). July and September 2022 monsoon rains caused catastrophic floods in Pakistan and it is one of the many outcomes of climate change which is affecting South Asia more than any other region. Although emitting less than 1 percent of global greenhouse gases, the population of the region is experiencing the impacts of climate change most sharply (Ali, et al. 2019). This problem is further compounded by industrialization, utilization of fossil fuel,

plastics, and involve deforestation. Building and managing reservoirs as well as constructing dams are also brought out in the assessment as effective ways of strengthening ecosystems and reducing flood occurrences (IPCC, 2022). The report has focused on integrating climate change agreements for the SA region accompanied with recommendations, with respect to which more funding be provide focusing on climate change and water; more priorities on options to reduce the probability of floods; and comes up with new adaptation policy based on information derived from various fields of study and policies (Adnan, 2024). Protecting ecosystems, human health, and economic stability—particularly in low- and middle-income nations—is emphasized by limiting global temperature rises to 1.5°C. What India and China decide will determine the planet's fate, and the international community must adjust its environmental policies to counteract the effect of climate change. Per Liu (2018).

A decrease in farming productivity due to climate change would have a disproportionate impact on regions already struggling with food insecurity, especially in Asia. Climate change is the primary cause of intense weather occurrences including heat waves, droughts, storms, floods, and new insect pests, hurt farmers' ability to make a living (IPCC, 2022). While there is some diversity in climatic trends when it comes to predicting climate extremes, future climate forecasts indicate a marked rise in temperature and more intense, unpredictable rainfall. Pakistan is expected to have a 2.8°C increase in maximum temperature and a 2.2°C decrease in minimum temperature over the mid-century (2040–2069), according to the IPCC (2022). Climate models project a 1.5°C rise in the global mean temperature from 2030 to 2050, which would disproportionately affect South Asia (Arehart, 2021). Extreme heat is also anticipated in arid regions of Pakistan, India, and western China. Southeast as well as South Asia will see more aridity as a result of less winter rainfall, while the monsoon season will bring unpredictable rainfall. According to Ahmed (2019), due to climatic anomalies, the world's sea level would rise by 2,100 millimeters. The future looks bleak for Asia in terms of heat waves, hot and dry days,

unpredictable rainfall, dust storms, and tropical cyclones. Losses in agricultural output in Asia are mostly caused by natural catastrophes such as storms, floods, drought, wildfires, and very hot or cold weather (Ahmed, 2019).

There are 262 million people in South Asia who are undernourished, making it the most food-insecure area in the world. Because of the lack of natural resources, rural inhabitants in distant drylands and deserts are particularly liable to the effect of climate change (Habibur Rahman et al. 2022). Floods, droughts, heat stress, cold waves, and storm are some of the climate-driven extremes that harm Asia's agricultural sector, especially the rice-wheat cropping system (Ahmed, 2019). Grain production and protein content are both diminished as a result of climate change's negative effects on wheat and rice harvests. Wheat production has decreased due to the elevated temperatures seen throughout the growing season. Wheat grain quality characteristics, including protein concentration, sugar percentage, and starch percentage, are also impacted by climate change. Growth qualities are enhanced by elevated temperatures and carbon dioxide levels, whereas protein content is reduced. Protein and soluble sugar levels drop under drought stress, but starch, sugar, and protein levels all drop with heat stress (Din, 2022). Variability in the climate and changes in agricultural management have altered crop phenology in China. Hotter weather has led to a rise in aphid infestations, which in turn has decreased wheat crop yields (Chen, 2018). Infectious illnesses, such as Fusarium head blight, which affects rice output, are strongly correlated with climate change. Consequently, the food security in Asia is under serious threat from climate change (Din, 2022).

Floods and droughts have concentrated rice yields in South Asia and other regions of the area, highlighting the enormous influence of climate variability on Asian rice production. Seed germination has been negatively impacted by heat stress, drought, floods, and cyclones, resulting in weak stand establishment and weak seedling vigor (Bao, 2019). The weight of rice grains, the number of spikelets or grains in the production system, and the commencement of panicles and small spikes are all negatively

impacted by high temperatures during the grain-filling stage. Reproductive phases and yield components, such as spikelets per panicle, grain size, or grain weight, are also negatively impacted by drought stress (Habibur Rahman et al. 2022).

Under RCP 8.5, the GLAM-Rice model projects a 45% drop in Southeast Asian rice output in the 80s, while climatic unpredictability has the probable to lower farming water productivity by 32% or 29% by the same year (Nasim, 2018). Extreme heat in Pakistan and China reduces rice yields during the booting and anthesis phases of development. Forage crops like maize and alfalfa suffer from heat stress, which lowers their yield and ultimately lowers their quality. As a result, there is a greater need for livestock products, yet fewer cattle will be available in the future due to predicted climate change. Restoring Asian forests to fulfill rising food, fiber, and medical needs requires an evaluation of climate adaptation options (Bao, 2019). Negative climate change consequences, such as resource loss, insect pests, illnesses, and increased food insecurity, also pose a danger to agroforestry output (Hashida, 2019).

Especially in China and Pakistan, Forests have also been hit hard by climate change, which has altered productive features, altered carbon dynamics, altered vegetation shifts, and depleted soil resources. Sea level rise, increased frequency and severity of cyclones, temperature fluctuations, and the intrusion of salt water from the Indus Delta have all contributed to a decline in habitat quality in Pakistan's aquaculture and fisheries while warming waters in South Asia have devastated China's marine fisheries (Ali, et al. 2019). Enhancing pro-climate & adaptative practices and tools in agriculture to promote sustainable yield is pertinent to counter the effects of climatic changes (Habibur Rahman et al. 2022).

CURRENT COLLABORATIVE EFFORTS – SUSTAINABLE STRATEGIES

The concept of sustainable development means the concern for the present and in the same time the concern for the future generations. One prominent theme within this region is the CPEC which has been a priority area for enhancing Sino-Pak cooperation right from the

1960s. An improvement in competitiveness in intercommunication, transportation and industrialism is the vision of the CPEC. Based on relevance of the environment, society, and economy into the subject of research, this study explores the likelihood of social and economic sustainability linked to CPEC. If social and environment alism is integrated into economic development strategies and action plans, merchant and trader decisions would be realistic and would not hinder commerce. Sustainability is a concept that is paramount to human existence; it encompasses aspects such as the conservation of the nation's resources, controlling of air pollution, and accommodation of waste. There are many objectives of the CPEC project in Pakistan and one of them is sustainable development. Regrettably, the project's implementation is affected because the principle of balanced social development seems to have been paid little attention in Pakistan's development due to the country's huge population increase. Achieving the demands with out compromising and ensuring fair distribution of natural resources are other facets of sustainable development, which is the ideal that the United Nations espouses as the way countries should manage excellence in economic, social and environmental spheres of development. Among different social sustainable development issues, gender disproportionate affects in health, education, and employment domains are one of those aspects where the CPEC project should focus. Such other elements as centralization, cost of public health care and also cost of elementary education are also other issues to consider. Facing deforestation together with water, air and soil pollution, Pakistan has a particularly difficult standing challenge. All these issues need to be addressed through robust civic society and the lasting measures. Through its investments in energy, infrastructure, and industrial development initiatives, the Silk Road Initiative (BRI) has the potential to hasten economic expansion. Pakistan and China have joined forces on the CPEC, an expansive initiative that would hopefully solve problems like corruption, taxation, foreign charges, resource scarcity, and economic crises. Lower trade costs, better economic cooperation, and more agricultural

exports are all ways in which the CPEC will help Pakistan's economy grow. With an emphasis on energy, commerce, and development in outlying regions, the project will also improve routes for tourism, trade, and development. Developing a sustainable development plan on a regional, national, and international scale should be a top priority for the government, as should giving the tourist sector top billing on social and economic indicators (Ali Shah, 2022).

Over 140 nations have signed agreements with China since 2013, demonstrating the country's strong promotion of the Green Belt and Road. The combined GDP and carbon emissions of these nations amount to 22% and 30.8%, respectively. To encourage environmentally responsible growth and the construction of the Green Belt and Road, China has released policy papers that businesses may follow. Chinese investments in the energy sectors of Belt and Road nations' renewable energy sources outpaced those of fossil fuels in the first half of 2020. As part of its Belt and Road Initiative, the Chinese government formed the BRIGC to encourage collaboration in environmentally friendly technologies. The Mozura wind power project in Montenegro is just one example of how Chinese firms are aggressively sharing their green project expertise. China should build the Green Belt and Road by exploring, innovating, and adapting to the local circumstances of the Belt and Road nations. Given the high initial cost and low expected return on investment for green infrastructure projects, green investment and financing might help the Belt and Road initiative get off the ground. Assistance and support in sectors such as green energy, technology, financing, and manufacturing should be provided via a national platform for green development information sharing.

Natural disasters and sustainable development have always been challenges to the china-pakistan transportation corridor (CPTC). This research contributes to bring to the practitioner's local triage a way of evaluating sustainable development indicators as a part of the CPTC sustainable development effort. Concerning the analyzed eleven SDGs, the framework consists of twenty-seven Tier I indicators, and eight Tier II metrics. An assessment of the CPTC's sustainable

development level is conducted for the years 2015, 2017, and 2020 based on the proposed assessment approach which is multidimensional and contains a single target. The targets of the places are analyzed, and the result shows that Xinjiang has the highest sustainable development level for the individual goals. However, regarding the development for sustainability, Khyber Pakhtunkhwa is at the lowest rank. In general, it is verified that more progress has been attained by the Islamabad Capital Territory especially for the SDGs 5, 8, and 9. Also, the extent of SDG6 and SDG11 importance are higher in Punjab than the extent of both least important SDGs, namely, SDG2 and SDG3. The Tunisian sustainable development level based on a multi-dimensional investigation at the CPTC has been increasing gradually. However, there has been a "regression" in Khyber Pakhtunkhwa's social and environmental aspects. While Khyber Pakhtunkhwa did not see a gain in sustainable development, all of the other CPTC provinces did, according to the overall review findings (Hao, 2024)

Cooperation between China and Pakistan via the (CPEC) would help mitigate climate change's adverse impacts, hasten the green transition, and promote low-carbon growth. Achieving carbon neutrality and reducing carbon footprints have become more achievable because of China's low-cost technology and products in new energy domains, which are now propelling the worldwide shift to renewable energy. Electric car battery development relies on green metals like lithium and nickel, which Pakistan and China may jointly investigate. Implications for the world at large may arise from the fact that the United States has raised tariffs on green energy transition technologies exported by China, which would impede international efforts to develop low-carbon and climate-resilient solutions. Furthermore, Pakistan is strongly encouraged to engage in green diplomacy to facilitate the international exchange of green technology. China spent billions on coal, renewable, and hydroelectric projects in Pakistan's energy industry during the first phase of CPEC (People's Daily Online, 2024).

To further their shared goal of protecting the environment, Pakistan and China have signed

an MoU (Memorandum of Understanding). Integrated meteorological observation stations, 5,000 sets of solar home systems, and integrated cloud-based early warning systems are among the commodities aimed at tackling climate change that the MoU seeks to supply under South-South Cooperation (Beijing, 2023). Pakistani authorities would also get access to capacity-building programs offered by China. The signing of the MoU would help Pakistan in its pursuit of renewable energy and in strengthening its capacity to deal with disasters. In his remarks, Ambassador Moin-ul-Haque expressed gratitude to China for their continued cooperation and lauded the Global Development Initiative's (GDI) work to forge stronger alliances among poor nations in support of the Sustainable Development Goals outlined in the 2030 Agenda (Beijing, 2023). Officials in Pakistan have expressed their gratitude to China for their persistent efforts to strengthen South-South Cooperation on Climate Change. This site states that climate change is one area of collaboration between Pakistan and GDI, two organizations that became partners in November. The Pakistan Climate Change Act of 2017, the GCISC Act, and the Pakistan Environment Protection Act of 1997 are only a few of the climate change-related legislative instruments that Pakistan has enacted. Preserving resources linked to climate change variations and raising public awareness are the goals of these measures. National Climate Change Policy and Climate Change Policy Implementation Framework are the two primary published texts; both address vulnerable industries, such as agriculture and forestry. Additional metrics are as follows:

Among the many forms of control are taxes on polluting substances and restrictions on the sale of endangered species. Still, it seems that these rules have not had any actual impact on people's day-to-day lives. In addition to the executive branch, the judicial branch has taken action on climate change via decisions that established constitutional safeguards and new bodies like the Climate Change Commission. As a result of corporations' growing concern for social and environmental issues, Pakistan has also begun to adhere to ESG regulations. Pakistan is a growing nation that needs to deal with issues including slow infrastructure and

high gasoline prices. But things have been looking up since 2013 when the nation started reducing its carbon emissions and switching to renewable energy. (Dar Khan, 2024)

WAY FORWARD - CLIMATE ADAPTATION & MITIGATION

The urgent and present worldwide phenomena of climate change (CC) necessitates both adaptation strategies and efforts to mitigate its impact. Adaptation involves making immediate adaptations to climatic changes like floods, while mitigation focuses on decreasing emissions of greenhouse gases. According to Hussain (2019), these approaches are vital for progress in both the economy and the environment. Methodologies used in fields such as agriculture, manufacturing, forestry, transportation, and land use are of interest to researchers. With so many problems the globe has encountered in the last several decades, adaptation and mitigation are critical on a global and national scale. Policies and initiatives against CC must be developed on a worldwide scale if they are to be successful. Recent research on the worldwide adaptation and mitigation strategies about the sectoral implications of climate change (Ali, 2017).

Seasonal Variations And Cultivation Practices

In areas prone to frost, warmer weather may lengthen the growing season, allowing for longer-maturing cultivars with higher yields. Wheat, barley, cereals, and other crops with short maturation periods may benefit greatly from this as well, since it can provide for greater yields annually. In tropical and subtropical regions, when precipitation is scarce or agricultural production takes place later in the year, there may be fewer options for extending the planting season and increased reliance on annual precipitation pattern variability (Barrua, 2018).

New Varieties Of Crops

Similar to kiwi fruit, genetic components are needed for various harvests but are restricted. Recent research has shown that novel crop varieties are capable of adapting to a wide range of environmental stresses, including heat, drought, pest pressure, salt tolerance, and general crop yield and quality. A broader range

of traits may be introduced via genetic engineering and mapping. Complexity, consumer concerns, economic viability, and legal hurdles, especially in early predictions, have impeded the adoption of genetically modified crops (Akkari, 2016)

Changes In Management And Other Input Factors

Extra nitrogen and fertilizers are required for CO₂ use to reach its maximum potential. Excess nitrogen that plants do not use might end up in groundwater, the lake surface, or even in the atmosphere from land. Marine habitats are affected and human chronic diseases are associated with elevated nitrogen levels in groundwater sources. Research has looked at a variety of field operations, including cultivation and grain drying. (Hussain, 2019).

Technological And Socio-Economic Adaptation

The development of biofuels is essential for the stability of oil prices and has the potential to increase food production in nations that export oil. These nations may have to diversify their economies if they can't afford to continue subsidizing food imports as oil prices fall. Solar, hydro, wind, wave, and tidal power are some of the renewable energy options that resource-rich nations may explore. By decarbonizing the energy future, a thorough legislative framework may improve economic activity, employment, and welfare. The extraction of fossil fuels receives substantial governmental support from governments, and the shift to renewable energy is crucial to fulfilling the Paris Agreement's objectives (Anwar, 2021).

To tackle problems and foster synergies, policies on climate change (CC) adaptation and mitigation must be consistent with one another. Due to a lack of cohesion in policymaking at the federal and provincial levels, Pakistan is very susceptible to CC in the areas of water, agriculture, and energy. According to this idea, to accomplish development objectives, policies from all sectors must be consistent and aligned. It argues that complicated problems, like climate change, need coordinated solutions. The research points out places where Pakistan's climate change policies aren't integrated enough and

criticizes their consistency and compatibility with sustainable development objectives (World Commission on Environment and Development, 1987). Policy papers are evaluated using a qualitative content analysis, and CPEC's (the China-Pakistan Economic Corridor Initiative) ramifications are addressed. Findings show that PC varies among sectoral policies, with higher levels of coherence seen at the federal level. Water and agricultural policies handle CC issues more consistently than energy ones. If both the federal and provincial governments are serious about increasing CC PC, they should establish mechanisms for intergovernmental consultation over energy-related policies and cross-sector planning. The findings might be used to refine CPEC into a more environmentally friendly variant of the Belt and Road Initiative (BRI) in the region (Waheed, 2021).

With the help of available funds, Pakistan plans to cut its greenhouse gas emissions by as much as 20% by 2030. Primarily, it comes from the energy industry, then from farming and manufacturing. The decrease in water supply has had a profound effect on the agricultural sector. Adaptation and mitigation of climate change are interrelated challenges that need coordinated action. Both environmental impact assessments and strategic environmental evaluations are crucial. Yet, obstacles include incoherent policymaking, inadequate institutional coordination, and disjointed cross-sectoral planning. CPEC in Pakistan is an important issue. With the help of available funds, Pakistan plans to cut its greenhouse gas emissions by as much as 20% by 2030. Primarily, it comes from the energy industry, then from farming and manufacturing. The decrease in water supply has had a profound effect on the agricultural sector. Adaptation and mitigation of climate change are interrelated challenges that need coordinated action. Both environmental impact assessments and strategic environmental evaluations are crucial. Yet, obstacles include incoherent policymaking, inadequate institutional coordination, and disjointed cross-sectoral planning. CPEC in Pakistan is an important matter (Waheed, 2021).

Water Sector Policies

Environmental sustainability and stable economic viability are the goals of the National Water Policy, which seeks to improve and preserve ecosystems that rely on water. In order to develop and manage water resources sustainably, it is necessary to do CC adaptation and mitigation evaluations. Although KP drafted a drinking water policy in 2015 and GB adopted the National Water Policy, none of these regions has its own water management strategy. Although adaptation is recognized in PB's Water Policy, plans and efforts to mitigate climate change are not. Although environmental protection is a stated goal of the EPA, no policy pertaining to the water sector addresses climate change adaptation or mitigation in any depth.

Energy Sector Policies

Although the energy sector is accountable for 51% of Pakistan's greenhouse gas emissions, carbon capture as well as mitigation (CC) is not included in the country's energy rules. The primary focus of the Federal Power Policy (2013) and the Power Generation Policy (2015) is on energy affordability, efficiency, and financial viability, with CC receiving little attention whatsoever. Policy documents such as the KP Hydropower Policy of 2016 and the Electricity Generation Policy do not handle environmental concerns that affect many provinces.

Agriculture Sector Policies

The agricultural sector accounts for 43% of Pakistan's total emissions of greenhouse gases. The National Food Security Policy stresses the need of the industry adjusting to changing weather patterns and bouncing back fast from unexpected setbacks. Nevertheless, the issue of climate change is not addressed. Water, agriculture, and energy are all areas that the Pakistani Agriculture Policy addresses with CC adaptation and mitigation strategies, but the GB Agriculture Sector Policy says nothing about climate change either.

CC Policies

The water, agricultural, energy, transportation, forestry, and industrial sectors are all intended to include climate change edition and mitigation strategy into Pakistan's 2012

National Climate Change Policy (NCCP). To put the policy into action, both the federal government and the provinces need to devise strategies. On the other hand, the NCCP doesn't specify how to track success in using the framework. Because they believe that the current draft CCPs fail to address climate change in the context of water, agriculture, and energy, no interim governments have authorized CCPs. Climate change mitigation strategies are also recognized in the KP Province's CCP (2016), however there are no integrated mechanisms with policies other sector departments. Although some of the hydropower projects in the GB CC Strategy and Action Plan (2017) are passive and lack coordination mechanisms with other sectors, they are nonetheless considered in terms of their theoretical potential.

Development Plans and Strategies

The development plans of various countries, including the Federal and PB, recognize the importance of climate change adaptation and mitigation measures, but fail to incorporate climate change into their strategies. The National Sustainable Development Strategy together with the 17 Sustainable Development Goals (SDGs) emphasizes coordination of climate change and the environment in nationwide and provincial level policies. Still, the PB's Growth Strategy 2023 is a vulnerable document, which did not structure an implementation of climate change; it also did not establish an implementation of sustainable consumption and production practices. The KP's development strategy also takes account of the fact that development is accompanied by a change in the climate, but the concept of climate change is absent here.

CONCLUSION:

The localized evaluation of sustainable development within the China-Pakistan Transportation Corridor (CPTC) reveals varying degrees of progress across different regions. Despite the general patterns that suggest sustainability leadership, Xinjiang's position is opposite to Khyber Pakhtunkhwa's which faces numerous issues, including social and environmental. It is possible to conclude that both Islamabad Capital Territory and

Punjab show their comparative advantages in the achievement of certain SDGs, However, the data also implies that development in the named corridor is uneven. The outcomes stress that efforts toward progressive improvement of the Sino-Pakistani relations within the framework of CPEC and promoting green transitions and low-carbon development need greater concentration. Though legal changes have taken place, policy coordination and enforcement issues are still being looked for. The main barriers include but are not limited to a lack of integrated adaptation and mitigation plans and insufficient reference points on the way climate change affects sustainable development goals.

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