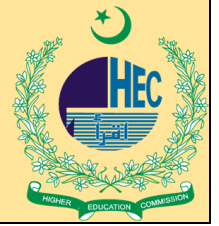



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Negotiating Sustainability in Central Asia: An Interpretive Analysis of Socio-Economic, Environmental, and Paradigmatic Pathways: From Soviet Legacies to Sustainable Futures: Interpreting the Central Asian Paradigm

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Abstract

Sustainability in Central Asia is neither a fixed trajectory nor a purely technocratic goal; it is a negotiated paradigm shaped by global discourses, national strategies, and everyday practices. This article examines the region's pursuit of socio-economic and environmental sustainability through the lens of the Sustainable Development Goals (SDGs), while situating these efforts within the region's historical legacies of Soviet industrialization, post-independence transitions, and contemporary authoritarian governance. Drawing on a critical review of recent scholarship and international reports, the analysis integrates three theoretical strands resilience theory, ecological modernization, and political ecology into a single interpretive framework. The findings reveal a persistent tension between state-led modernization projects, community-level resilience strategies, and the political ecologies of land, water, and migration. While governments emphasize "green economy" narratives and large-scale infrastructure, households often rely on migration and informal adaptation practices to sustain livelihoods. Regional water governance illustrates both the necessity and fragility of cooperation, as upstream downstream disputes remain unresolved. At the same time, authoritarian governance shapes sustainability discourses by privileging global image-building over participatory or inclusive practices. This study contributes to sustainability debates by reframing Central Asia's trajectory as plural, contested, and negotiated rather than linear or uniform. The argument underscores the importance of contextual sensitivity: global frameworks like the SDGs provide useful benchmarks, but they risk irrelevance unless translated into locally meaningful strategies. By synthesizing theory with empirical cases, the article advances an interpretive approach that humanises sustainability, recognizing it as a process rooted in lived realities and unequal power relations. Ultimately, the research highlights that the future of sustainability in Central Asia depends less on importing universal models than on acknowledging negotiation as its defining characteristic, where resilience, modernization, and political struggle converge in shaping the region's developmental pathways.

Keywords: *Central Asia, Sustainable Development Goals (SDGs), Resilience and Adaptation, Ecological Modernization, Political Ecology, Water Governance, Migration And Remittances, Authoritarian Governance*

Introduction

1. Background and Context

Sustainability has emerged as a defining paradigm of the twenty-first century, shaping how societies envision development, governance, and environmental stewardship. Anchored in the United Nations Sustainable Development Goals (SDGs), global sustainability discourse promotes a universal framework of economic growth, social inclusion, and ecological balance (United Nations, 2015). Yet, the application of these global goals in diverse contexts often produces outcomes that diverge from official narratives, as local histories, political systems, and community practices reshape sustainability in practice.

Central Asia—comprising Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan—represents a region where sustainability debates intersect with unique historical legacies and contemporary challenges. The collapse of the Soviet Union in 1991 left behind centralized economic structures, environmental degradation, and fragile governance institutions (Spoor, 1993; Pomfret, 2019). Among the starkest examples is the Aral Sea disaster, a symbol of unsustainable resource management under Soviet cotton monoculture, which continues to shape ecological and socio-economic realities (Micklin, 2016).

Since independence, Central Asian states have sought to redefine their development trajectories. However, they do so within the constraints of resource dependence, authoritarian politics, and global pressures to align with sustainability frameworks. Kazakhstan positions itself as a regional sustainability leader through modernization and green branding; Uzbekistan undertakes pragmatic agricultural reforms; Tajikistan invests in hydropower mega-projects; Kyrgyzstan navigates fragility through household-level resilience; and Turkmenistan maintains opacity in ecological governance (Sharshenova, 2021; UNDP, 2021). This diversity raises a central question: how is sustainability understood and practiced in Central Asia?

2. Historical Legacies of Unsustainability

Central Asia's sustainability dilemmas cannot be understood without grappling with its Soviet inheritance. The Soviet Union transformed the region into a hub of resource extraction and agricultural monoculture, subordinating ecological balance to production quotas and geopolitical ambitions (Spoor, 1993; Giese et al., 2021). Rivers were diverted to irrigate vast cotton fields in Uzbekistan and Turkmenistan, creating wealth for the Soviet center but leaving the Aral Sea—once the fourth-largest inland water body in the world—reduced to a fraction of its size (Micklin, 2016; Indoitu et al., 2022).

This disaster was not merely ecological; it had human consequences. Fishing communities lost their livelihoods, respiratory diseases surged due to toxic dust storms, and food insecurity worsened in areas dependent on degraded soils (Glantz, 2020). These impacts reinforced inequalities, as peripheral rural communities bore the brunt of policies designed to serve Moscow's needs.

Independence in 1991 did not mark a clean break. The newly sovereign states inherited centralized governance systems and fragile economies, deeply tied to single-resource dependencies—whether hydrocarbons in Kazakhstan and Turkmenistan or cotton in Uzbekistan and Tajikistan (Pomfret, 2019). The sustainability challenges facing the region today are thus embedded in a long historical arc of ecological degradation and authoritarian governance.

3. Regional Challenges and Divergent Trajectories

Despite shared legacies, the five Central Asian republics have navigated sustainability in divergent ways, shaped by their resource endowments, political institutions, and external partnerships.

- Kazakhstan has positioned itself as a regional sustainability leader, branding its “Green Economy Concept” as a bridge between modernization and ecological responsibility. Yet its economy remains heavily reliant on hydrocarbons, raising doubts about the depth of its green transition (OECD, 2023; Sharshenova, 2021).
- Kyrgyzstan, resource-poor and politically fragmented, demonstrates sustainability primarily through grassroots resilience. Labor migration—accounting for over 30% of GDP—has become a household strategy to cope with climate and economic shocks, even though it rarely features in official sustainability reports (IOM, 2022; World Bank, 2022).
- Tajikistan has embraced hydropower as its development paradigm, casting mega-dams like Rogun as both national pride and a sustainable future. Yet these projects spark regional disputes with Uzbekistan and Afghanistan while displacing vulnerable communities (Peyrouse, 2023; Sehring, 2009).
- Uzbekistan, long tied to forced labour in cotton, has begun agricultural reforms under President Mirziyoyev, reducing reliance on cotton monoculture and experimenting with diversification. International agencies hail these reforms as aligning with the SDGs, though water use efficiency and environmental justice remain unresolved (Lerman & Sedik, 2023; Abdullaev et al., 2020).
- Turkmenistan remains an outlier, where secrecy and authoritarianism make sustainability discourse virtually invisible. Hydrocarbon dependency persists, while the lack of transparent data obstructs both domestic accountability and global monitoring (UNDP, 2021; Freedom House, 2023).

Together, these cases reveal that sustainability in Central Asia is plural, uneven, and contested. It cannot be captured by global metrics alone but must be understood as a negotiation between state-led ambitions, external pressures, and everyday survival strategies.

4. Global Frameworks and Local Realities

The adoption of the Sustainable Development Goals (SDGs) has created new opportunities for Central Asian governments to signal progress and attract investment. Kazakhstan’s “Green Bridge” initiative and Uzbekistan’s “Development Strategy 2030” are explicitly aligned with SDG frameworks (UNDP, 2021).

Yet the reality is more complex. Indicator-driven assessments often fail to capture the lived experiences of sustainability. For instance:

- Rural households in Kyrgyzstan and Tajikistan rely on informal water-sharing practices and seasonal migration, neither of which are visible in SDG reporting (IOM, 2022).
- The ecological consequences of hydropower expansion in Tajikistan are presented as “clean energy” achievements but mask local displacement and ecological risks (Peyrouse, 2023).
- In Turkmenistan, the absence of reliable statistics means global monitoring frameworks are blind to on-the-ground realities (Freedom House, 2023).

This disjuncture highlights the limitations of Universalist approaches and the need for interpretive methods that attend to discourse, power, and local practices (Wilson, 2019; McCarthy, 2020).

5. Research Gaps in the Literature;

While scholarship on Central Asian sustainability has grown, three major gaps remain:

1. Historical–Conceptual Gap: Studies on Soviet legacies (e.g., Aral Sea) remain siloed from contemporary sustainability discourses. How these legacies shape present-day paradigms are still under-theorized (Indoitu et al., 2022; Glantz, 2020).
2. Comparative–Regional Gap: Research often privileges single-country case studies—Kazakhstan’s energy sector, Uzbekistan’s reforms—without placing them in a comparative regional framework (Sehring, 2009; Abdullaev et al., 2020).
3. Theoretical–Methodological Gap: Positivist approaches dominate, focusing on technical reforms and ecological metrics, while interpretive and critical approaches—emphasizing narratives, practices, and power—remain limited (Robbins, 2019; Wilson, 2019).

This study addresses these gaps by combining historical grounding, comparative regional analysis, and theoretical pluralism.

6. Theoretical and Conceptual Framework;

This article employs an interpretive framework to analyse sustainability as a negotiated paradigm. It integrates three perspectives:

- Ecological Modernization Theory (EMT): Sustainability as compatible with modernization and technological innovation, useful for examining Kazakhstan’s modernization discourse and Uzbekistan’s reforms (Mol & Sonnenfeld, 2000; Hajer, 1995).
- Resilience Theory: Sustainability as community adaptation to shocks, relevant for Kyrgyzstan and Tajikistan, where migration and informal networks sustain livelihoods (Folke, 2006; Berkes & Ross, 2013).
- Political Ecology: Sustainability as contested, shaped by power and inequality, evident in transboundary water conflicts and authoritarian silences (Robbins, 2019; Shtaltovna, 2020).

By combining these, the article reframes sustainability as plural, contested, and embedded in historical and political contexts.

7. Aim and Contribution;

The study aims to provide a human-centered, theoretically informed reinterpretation of sustainability in Central Asia. Its contributions are threefold:

1. Historically grounded: It situates sustainability within Soviet legacies of environmental degradation and centralized governance.
2. Comparative and regional: It analyses diverse sustainability trajectories across the five republics, highlighting convergences and divergences.
3. Conceptually original: It integrates ecological modernization, resilience, and political ecology into a unified interpretive lens, advancing global debates on sustainability.

By doing so, the article reframes Central Asia as more than a peripheral region—it becomes a critical site of negotiation between global frameworks, state agendas, and everyday resilience, offering insights for sustainability studies more broadly.

8. Rationale;

Existing research on sustainability in Central Asia has emphasized environmental degradation, water management, and economic dependency (Abdullaev & Rakhmatullaev, 2015; Sehring, 2009). While valuable, much of this work remains technical and descriptive, focusing on ecological indicators or institutional reforms. Less attention has been paid to the discursive, paradigmatic, and human-centered dimensions of sustainability—that is, how it is framed by states, contested by communities, and negotiated through power relations.

At the same time, global debates on sustainability have often overlooked post-Soviet and non-Western contexts, where authoritarian governance, transboundary ecological challenges, and everyday adaptation practices play central roles. By examining sustainability in Central Asia, this

study highlights not only a region-specific experience but also contributes to broader theoretical debates about how sustainability is translated, resisted, and redefined in varied contexts.

Literature Review:

2.1 Historical legacies of environmental degradation;

The sustainability challenges in Central Asia cannot be understood without reference to the Soviet legacy. Extensive irrigation schemes, large-scale cotton monoculture, and extractive industrial projects fundamentally reshaped ecosystems while embedding structural vulnerabilities. The most visible consequence is the Aral Sea disaster, which transformed once-thriving fishing communities into zones of ecological collapse and economic displacement (Micklin, 2016; Indoitu, Orlovsky, & Orlovsky, 2022). Beyond this emblematic case, widespread salinization, soil degradation, and desertification continue to undermine agricultural productivity and public health (Glantz, 2020).

Scholarship emphasizes that these crises were not merely ecological accidents but socially engineered outcomes of centralized planning and state priorities (Spoor, 1993; Giese, Sehring, & Wegerich, 2021). This insight underscores the importance of examining sustainability not only as environmental management but also as a product of political and economic decision-making across historical trajectories.

Gap identified: While the ecological consequences are well documented, less attention has been paid to how these historical scars shape contemporary discourses of sustainability and the symbolic uses of “green” language by post-Soviet governments.

2.2 Transboundary water governance and hydro politics;

Water governance has emerged as one of the most contested arenas of sustainability in Central Asia. Upstream states (Kyrgyzstan and Tajikistan) prioritize hydropower development, while downstream states (Uzbekistan, Turkmenistan, Kazakhstan) emphasize irrigation for agriculture. These competing demands have produced recurrent tensions, with projects such as Tajikistan’s Rogun Dam symbolizing both national pride and regional discord (Sehring, 2009; Peyrouse, 2023).

The institutional legacy of Soviet water allocation, combined with weak regional cooperation mechanisms, further exacerbates disputes (Abdullaev & Rakhmatullaev, 2015). Initiatives such as the International Fund for Saving the Aral Sea (IFAS) have struggled to move beyond technical management, as geopolitical rivalries often supersede collective problem-solving (Giese et al., 2021).

Gap identified: Much of this literature has focused on institutions and technical solutions. What remains underexplored is the discursive dimension of water politics—how states frame water projects as sustainability, sovereignty, or modernity, and how local communities adapt through informal water-sharing practices that rarely enter policy discourse.

2.3 Political economy and authoritarian sustainability;

The political economies of Central Asian states are marked by resource dependency and authoritarian or hybrid governance structures. Kazakhstan and Turkmenistan remain hydrocarbon-dependent, while Uzbekistan has historically relied on cotton monoculture and Kyrgyzstan and Tajikistan on remittance-driven economies (Pomfret, 2019; Olcott, 2012). These structural constraints limit diversification and create political incentives to use sustainability narratives selectively.

Scholars note that sustainability is often deployed as state branding, reinforcing legitimacy at home and credibility abroad. Kazakhstan’s “Green Economy” and Uzbekistan’s agricultural reforms exemplify how sustainability is aligned with modernization discourses but rarely accompanied by deep institutional change (Sharshenova, 2021; Lerman & Sedik, 2023). In

Turkmenistan, sustainability is largely absent from public debate, with the state suppressing critical engagement (McCarthy, 2020).

Gap identified: While political economy analyses highlight dependency and elite capture, there is still insufficient comparative work on how authoritarian regimes instrumentalize sustainability language—and how such discursive practices differ from democratic or participatory contexts.

2.4 Resilience, migration, and everyday adaptation;

Parallel to top-down state discourses, a growing body of research examines resilience from below. Households and communities in Kyrgyzstan and Tajikistan, for instance, adapt to climate shocks, water scarcity, and economic precarity through migration, remittances, and informal governance mechanisms (IOM, 2022; World Bank, 2022). These practices sustain livelihoods and, in some cases, substitute for weak state capacity.

Informal water user associations and community-based resource-sharing illustrate adaptive governance at micro-levels, even where formal institutions are fragmented (Abdullaev & Rakhmatullaev, 2015). Moreover, resilience is often gendered: women disproportionately bear the burden of sustaining household economies amid male outmigration, yet their roles remain underrepresented in policy discourse (Bissenova, 2022).

Gap identified: While resilience is acknowledged, it is often treated descriptively or quantitatively. There is a lack of interpretive research connecting everyday adaptation to broader sustainability paradigms, and of work that examines whose resilience is made visible or invisible in global frameworks such as the SDGs.

2.5 Global frameworks and the politics of sustainability language;

Since adopting the Sustainable Development Goals (SDGs), Central Asian states have increasingly aligned national strategies with global sustainability rhetoric. Kazakhstan's Green Bridge initiative, Uzbekistan's diversification programs, and Tajikistan's hydropower expansion have all been framed as contributions to global sustainability (UNDP, 2021).

Yet critical scholarship highlights the mismatch between global indicators and local realities. Migration, informal irrigation, and grassroots adaptation rarely feature in SDG monitoring, while authoritarian opacity—especially in Turkmenistan—renders sustainability outcomes invisible (Wilson, 2019; Freedom House, 2023). International donor programs, while influential, risk reinforcing elite-driven agendas rather than empowering communities (McCarthy, 2020).

Gap identified: Current research often reproduces state narratives or donor frameworks without critically interrogating how sustainability is selectively articulated, silenced, or contested in different contexts.

2.6 Integrating theoretical approaches;

Three strands of theory dominate sustainability debates:

- Ecological modernization explains state-led, technocratic reforms but underestimates authoritarian instrumentalization (Mol & Sonnenfeld, 2000; Hajer, 1995).
- Resilience theory highlights adaptation but risks neglecting inequality and power (Folke, 2006; Berkes & Ross, 2013).
- Political ecology interrogates power, exclusion, and silence but is less attentive to moments of cooperation or resilience (Robbins, 2019).

Central Asia demonstrates the need for a synthetic interpretive framework that combines these perspectives. Sustainability here emerges as a negotiated paradigm—plural, contested, and dynamic—shaped by global frameworks, state discourses, community practices, and regional dynamics.

2.2 Country-Specific Literature:

2.2.1 Kazakhstan: Ecological modernization and green branding;

Kazakhstan presents itself as a regional leader in ecological modernization, adopting a “Green Economy Concept” in 2013 and spearheading initiatives such as the Green Bridge Partnership (Sharshenova, 2021). The state’s strategy emphasizes renewable energy, diversification, and international cooperation, aligning closely with SDG discourse (UNDP, 2021). Scholars argue, however, that these initiatives often serve symbolic purposes, projecting modernity and global integration while the economy remains structurally dependent on oil and gas exports (Olcott, 2012; Pomfret, 2019).

Grassroots environmental activism has emerged in response to urban pollution and industrial impacts, yet civil society remains constrained by political centralization (Freedom House, 2023). The literature thus frames Kazakhstan as a case of “green branding” authoritarianism—where sustainability discourse bolsters legitimacy but rarely transforms underlying political-economic structures.

2.2.2 Kyrgyzstan: Resilience from below;

Unlike its resource-rich neighbors, Kyrgyzstan faces weak state capacity and fragmented governance (Sehring, 2009). As a result, sustainability here is often enacted at the community level. Informal irrigation associations, reciprocal water-sharing, and transnational remittances form the backbone of rural adaptation (IOM, 2022; World Bank, 2022). Migration is particularly central: nearly one-third of the working-age population works abroad, and remittances constitute around 30% of GDP, shaping livelihoods and resilience (World Bank, 2022).

Scholars note that while international donors engage with Kyrgyzstan’s sustainability agenda, global frameworks often fail to capture these invisible forms of resilience (Abdullaev & Rakhmatullaev, 2015). The Kyrgyz case thus illustrates how sustainability is sustained through everyday practices, not top-down state strategies.

2.2.3 Tajikistan: Hydropower modernity and fragile livelihoods;

In Tajikistan, sustainability discourses revolve around hydropower. The Rogun Dam and similar projects are framed as national symbols of modernity, energy independence, and sustainable development (Peyrouse, 2023). These projects attract donor financing and align with SDG goals on clean energy, but critical scholarship highlights their social and geopolitical costs: community displacement, fragile rural livelihoods, and tensions with downstream neighbors (Sehring, 2009; Abdullaev & Rakhmatullaev, 2015).

At the household level, migration plays an even greater role than in Kyrgyzstan, with remittances constituting more than 30% of GDP (IOM, 2022). Informal irrigation practices and community coping mechanisms persist, but they operate under conditions of vulnerability, reflecting both resilience and structural precarity.

The literature thus positions Tajikistan as a case of hydropower modernity, where sustainability rhetoric coexists with unresolved inequities and risks.

2.2.4 Uzbekistan: Authoritarian reformism and agricultural diversification;

Since 2016, Uzbekistan has pursued a reformist agenda under President Mirziyoyev, positioning sustainability as part of national modernization. Key initiatives include reducing reliance on cotton monoculture, diversifying crops, and improving irrigation efficiency (Lerman & Sedik, 2023). International actors have celebrated these reforms as aligning with the SDGs and improving rural livelihoods.

Yet critical studies reveal contradictions. While reforms reduce forced labor and expand diversification, they do not resolve structural water stress or rural inequalities (Abdullaev, Giordano, & Rasulov, 2020). Community-level practices—such as crop diversification, migration, and informal water-sharing—remain essential to household sustainability but are rarely recognized in state or donor metrics.

Uzbekistan thus exemplifies authoritarian reformism: sustainability is embraced as modernization rhetoric, but deeper political reforms and participatory governance remain limited.

2.2.5 Turkmenistan: Sustainability in silence;

Turkmenistan represents the most opaqued case. Official discourse emphasizes natural gas exports and grand infrastructure projects, with occasional references to environmental issues. The state has formally committed to the SDGs, but reliable data are scarce, and sustainability rarely enters public debate (Freedom House, 2023).

Scholars note that authoritarian opacity functions as a political strategy, rendering sustainability effectively invisible (McCarthy, 2020). Community practices exist—likely revolving around local coping with desertification and water scarcity—but remain largely undocumented. The literature thus frames Turkmenistan as a case of sustainability in silence, where discourse is suppressed, data absent, and research gaps most profound.

2.3 Comparative insights from the country literature:

Taken together, these five cases demonstrate how sustainability in Central Asia is plural, contested, and uneven:

- Kazakhstan and Uzbekistan deploy sustainability as modernization branding.
- Kyrgyzstan and Tajikistan sustain livelihoods through bottom-up resilience practices, particularly migration.
- Turkmenistan illustrates the politics of silence, where sustainability is absent from discourse.

This comparative perspective highlights both convergence (Soviet ecological legacies, dependency, adaptation through migration) and divergence (authoritarian branding, community resilience, authoritarian silence).

2.4 Theoretical positioning:

The countries literature aligns with and extends three major theoretical strands:

- Ecological modernization explains the discursive strategies of Kazakhstan and Uzbekistan but struggles to capture authoritarian instrumentalization.
- Resilience theory illuminates the community practices of Kyrgyzstan and Tajikistan but underestimates inequality and invisibility.
- Political ecology best explains the silences and power asymmetries in Tajikistan's hydropower and Turkmenistan's opacity, yet it can overlook everyday resilience.

The Central Asian experience thus underscores the need for a synthetic interpretive framework that treats sustainability as a negotiated paradigm, emerging at the intersection of global frameworks, state discourses, community practices, and regional dynamics.

2.7 Conclusion of the Review:

The literature establishes Central Asia as a region of profound ecological challenges, structural economic constraints, and fragile governance. Yet it also highlights remarkable everyday adaptation and resilience. What is missing are comparative, interpretive, and human-centered analyses that connect historical legacies with contemporary sustainability discourses and practices. Addressing this gap, the present study applies a plural theoretical framework to investigate sustainability in Central Asia as a negotiated paradigm, advancing both empirical understanding and conceptual debates.

3. Theoretical and Conceptual Framework:

3.1 Positioning sustainability within contested theoretical traditions;

The concept of sustainability has been shaped by multiple, and sometimes competing, theoretical traditions. Each tradition provides useful insights but also carries important blind spots when applied to the Central Asian context.

Ecological modernization theory;

Ecological modernization (EMT) argues that environmental protection can be reconciled with economic growth through technological innovation, regulatory reform, and state-led policy transformation (Mol & Sonnenfeld, 2000; Hajer, 1995). In advanced industrial societies, EMT explains the rise of renewable energy transitions, environmental regulation, and green innovation. Applied to Central Asia, EMT helps illuminate Kazakhstan's Green Economy initiatives and Uzbekistan's post-2016 agricultural reforms, which invoke sustainability as modernization and international integration (Sharshenova, 2021; Lerman & Sedik, 2023).

Yet EMT faces sharp limitations in authoritarian contexts. In Kazakhstan and Uzbekistan, sustainability discourses often serve legitimation strategies rather than structural transformation. Moreover, EMT assumes institutional reflexivity the capacity of states to adapt policies through open debate and learning that is often absent in Central Asia's political regimes (Freedom House, 2023).

Resilience theory;

Resilience scholarship highlights the capacity of social-ecological systems to absorb shocks and adapt to change while maintaining functionality (Folke, 2006; Berkes & Ross, 2013). In Central Asia, resilience is vividly observed in everyday coping practices: migration, remittances, informal irrigation, and household-level adaptation (IOM, 2022; World Bank, 2022). This lens helps explain why fragile states like Kyrgyzstan and Tajikistan persist despite economic precarity and climate vulnerability.

However, resilience theory often suffers from a normative bias framing adaptation as inherently positive while overlooking the inequalities, exclusions, and invisible burdens it entails (Bissenova, 2022). For instance, the heavy reliance on women's unpaid labor or the vulnerability of remittance-dependent households rarely features in resilience metrics.

Political ecology;

Political ecology (PE) examines the power relations, exclusions, and silences that structure environmental governance (Robbins, 2019). In Central Asia, PE is particularly useful for analyzing how Tajikistan frames hydropower as sustainable modernity despite displacement, or how Turkmenistan's authoritarian opacity renders sustainability discourse invisible (McCarthy, 2020). PE exposes the politics of silence: what is not said, not measured, or deliberately concealed.

Yet PE often emphasizes conflict and exclusion to the neglect of cooperation and resilience. Everyday practices of adaptation, such as informal water-sharing or grassroots activism in Kazakhstan, can be overshadowed when analysis focuses only on domination and resistance.

3.2 Beyond single frameworks: the case for synthesis;

The Central Asian evidence demonstrates that no single theoretical tradition sufficiently captures the complexity of sustainability in the region:

- EMT explains state modernization branding but neglects authoritarian instrumentalization.
- Resilience theory highlights bottom-up adaptation but underestimates inequality and invisibility.
- Political ecology reveals power and exclusion but often sidelines everyday resilience.

Thus, a synthetic approach is required—one that integrates the strengths of each perspective while correcting their limitations. This synthesis must also remain interpretive: sensitive to meaning, discourse, and lived experience, rather than reducing sustainability to technocratic indicators or narrow economic rationalities.

3.3 Conceptualizing sustainability as a negotiated paradigm;

Drawing on the literature and theoretical debates, this study conceptualizes sustainability in Central Asia as a negotiated paradigm. By this, we mean sustainability is neither a fixed policy set nor a universal blueprint, but an emergent outcome of multiple, overlapping, and sometimes contradictory forces:

1. Global frameworks – The SDGs, international donors, and organizations provide financial support and discursive legitimacy, but often impose a one-size-fits-all metric that mismatches local realities (Wilson, 2019).
2. State discourses – Governments invoke sustainability to project modernization, sovereignty, or legitimacy, but their agendas often prioritize symbolic performance over substantive change (Olcott, 2012; Sharshenova, 2021).
3. Community practices – Households and local communities sustain livelihoods through migration, informal governance, and reciprocal practices that rarely enter official sustainability narratives (IOM, 2022).
4. Regional dynamics – Shared ecosystems (Aral Sea, Transboundary Rivers) and geopolitical rivalries condition sustainability as a site of both cooperation and conflict (Abdullaev & Rakhmatullaev, 2015).

The interaction of these dimensions produces sustainability as a plural and contested field—a space where discourses compete, practices adapt, and silences persist.

3.4 Visualizing the framework;

The conceptual diagram (Figure 1, earlier) illustrates this framework. Sustainability emerges at the intersection of four forces: global frameworks, state discourses, community practices, and regional dynamics. Rather than privileging one perspective, the model captures how sustainability is co-produced through negotiation, contestation, and adaptation.

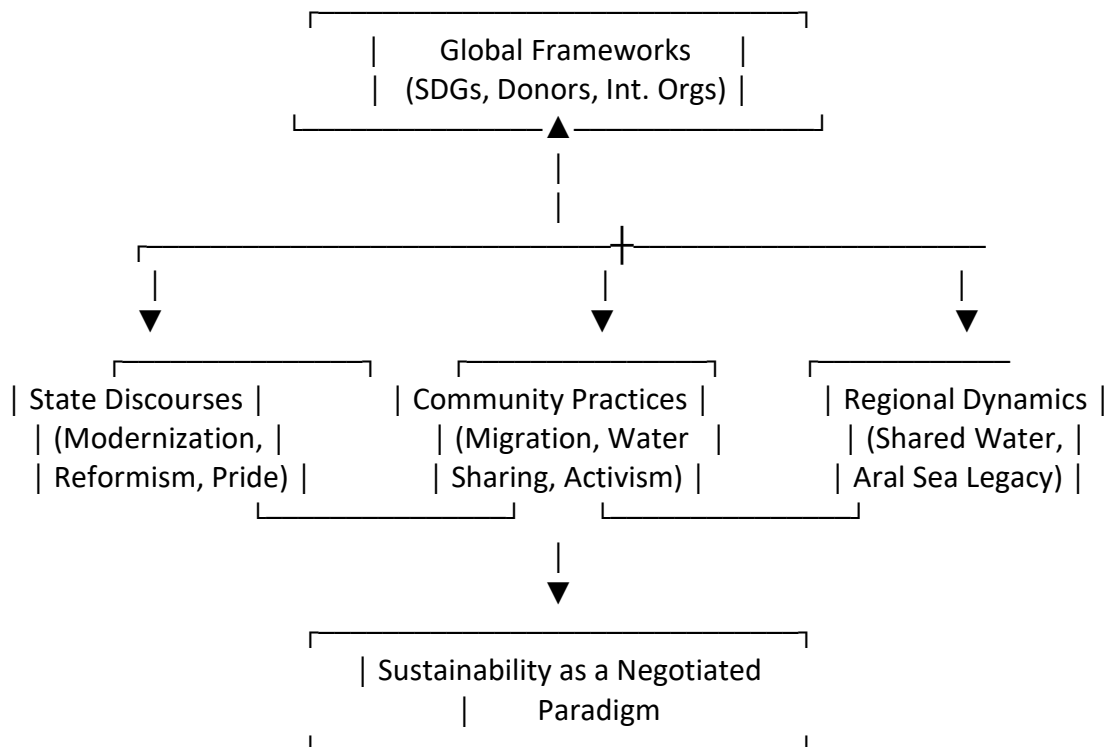
This interpretive framework enables a comparative analysis that highlights both convergences (shared legacies of ecological degradation, reliance on migration, authoritarian governance) and divergences (branding vs. silence, hydropower modernity vs. grassroots resilience).

3.5 Contribution of the framework;

By framing sustainability as a negotiated paradigm, this study contributes to three scholarly debates:

- It extends ecological modernization by analyzing its selective use in authoritarian branding rather than democratic reflexivity.
- It deepens resilience scholarship by showing how adaptation is uneven, gendered, and often invisible in formal indicators.
- It advances political ecology by balancing attention to power and exclusion with recognition of resilience and cooperation.

In doing so, the framework offers a humanized, plural, and interpretive account of sustainability in Central Asia, one that challenges the dominance of technocratic or donor-driven approaches.



4. Empirical Analysis – Sustainability Pathways in Central Asia:

4.1 Kazakhstan: Branding Sustainability through Modernization;

Kazakhstan has often positioned itself as the regional leader in sustainability, leveraging its energy wealth and political stability to pursue ambitious modernization projects. Since the adoption of its Green Economy Concept in 2013, the government has pledged to derive 50% of its energy from renewable sources by 2050 and has launched initiatives such as the Green Bridge Partnership Program to showcase global leadership (Sharshenova, 2021).

However, beneath this modernization discourse, contradictions remain. Hydrocarbons continue to account for around 60% of exports and nearly half of state revenues, binding Kazakhstan to carbon-intensive growth (OECD, 2023). Ecological modernization theory helps explain this paradox: sustainability is framed as compatible with modernization and global competitiveness rather than a departure from fossil dependency (Mol & Sonnenfeld, 2000).

The human dimension is equally important. Air pollution in cities like Almaty and Karaganda remains a public health crisis, disproportionately affecting poorer households (WHO, 2021). Grassroots environmental activism—such as the Oyen Qazaqs tan movement—has begun to challenge state narratives, but political space for civil society remains constrained (Freedom House, 2023). Thus, Kazakhstan exemplifies a hybrid sustainability paradigm: global branding, selective reforms, and continued structural dependence.

4.2 Kyrgyzstan: Resilience from Below;

In contrast to Kazakhstan’s resource wealth, Kyrgyzstan is often described as resource-poor but socially adaptive. Since independence, political volatility, weak governance, and climate vulnerability have limited the state’s capacity to implement sustainability policies (Giese et al., 2021). Instead, resilience is enacted primarily at the household and community level.

Labor migration has become Kyrgyzstan’s most significant adaptation strategy, with remittances constituting over 30% of GDP (World Bank, 2022). This reliance on migration reshapes rural

livelihoods: households invest remittances into small-scale agriculture, housing, and education, creating a decentralized form of socio-economic resilience (IOM, 2022).

Yet migration is not a panacea. It leaves behind care gaps, reshapes gender roles, and creates dependency on external labour markets (Bissenova, 2022). Political ecology highlights how global inequalities shape these dynamics: sustainability here is less about green growth and more about negotiating survival within transnational labour regimes.

Environmental challenges compound these pressures. Climate change is intensifying glacier melt, threatening long-term water security and hydropower capacity (Peyrouse, 2023). Community-based water user associations illustrate resilience through collective action, but they face chronic underfunding and political interference (Sehring, 2009). Kyrgyzstan thus represents a case where sustainability is bottom-up, fragile, and human-centered—largely invisible in official SDG reporting.

4.3 Tajikistan: Hydropower Dreams and Regional Tensions;

Tajikistan has cast hydropower as the cornerstone of its sustainability paradigm. The Rogun Dam, projected to be the tallest in the world, symbolizes the state's vision of achieving energy independence, export capacity, and climate-friendly development (Peyrouse, 2023). In official discourse, hydropower aligns with both national pride and SDG commitments to clean energy.

Yet the reality is deeply contested. Construction has displaced thousands of people, raising questions about environmental justice and social equity (World Bank, 2021). Downstream states, particularly Uzbekistan until recently, opposed the project due to concerns over water access for agriculture. This reveals the political ecology of sustainability: resource projects are arenas of power, conflict, and negotiation rather than neutral "green" solutions (Robbins, 2019).

Resilience at the community level tells another story. Labor migration—similar to Kyrgyzstan—sustains households amid limited domestic opportunities, accounting for over 25% of GDP (IOM, 2022). Rural communities face mounting challenges from climate variability, including glacier retreat and water scarcity, which threaten traditional agricultural systems (Indoitu et al., 2022). Tajikistan thus embodies a dual sustainability narrative: a top-down vision of hydropower modernity juxtaposed with bottom-up resilience strategies, both shaped by unequal power dynamics within and beyond the region.

4.4 Uzbekistan: Reforming Cotton and Reframing Sustainability;

Uzbekistan has undergone the most visible transformation in sustainability policy since the leadership transition of 2016. Long criticized for forced labor in the cotton sector, Uzbekistan has abolished state quotas and initiated reforms to diversify agriculture, reduce water intensity, and align with international human rights standards (Lerman & Sedik, 2023; Abdullaev et al., 2020). These reforms reflect elements of ecological modernization: the state seeks to reposition itself as a responsible actor in global markets, using sustainability as a tool of legitimacy and modernization (Hajer, 1995). Yet contradictions persist. Cotton remains central, and water efficiency gains are uneven across regions. Moreover, environmental justice concerns—such as the impact of salinization and degraded soils on rural livelihoods—remain unresolved (Indoitu et al., 2022).

At the grassroots level, communities adapt through crop diversification, migration, and informal water-sharing practices (Abdullaev & Rakhmatullaev, 2015). These practices reveal a resilience not captured in top-down reforms. Political ecology highlights that while international actors celebrate Uzbekistan's reforms, marginalized rural groups continue to face ecological and economic precarity.

Uzbekistan thus illustrates how authoritarian reformism can reframe sustainability: visible progress in global discourse, uneven realities on the ground.

4.5 Turkmenistan: Sustainability in Silence;

Turkmenistan represents the silenced edge of sustainability debates in Central Asia. The state maintains strict control over information, with environmental data largely unavailable and civil society absent from sustainability discourse (Freedom House, 2023). Official reports emphasize large-scale infrastructure projects and hydrocarbon wealth, but offer little transparency on ecological or social impacts.

Hydrocarbon dependence defines Turkmenistan's development trajectory: natural gas accounts for the majority of exports and state revenues, anchoring the economy in unsustainable pathways (Pomfret, 2019). While the government references SDGs in formal commitments, there is little evidence of systematic alignment or monitoring (UNDP, 2021).

From a political ecology perspective, silence itself is a strategy. By controlling narratives and restricting information, the state prevents sustainability from becoming a contested paradigm. At the community level, resilience practices exist but remain undocumented, as independent research faces heavy restrictions (McCarthy, 2020).

Turkmenistan thus reveals how sustainability can be rendered invisible by authoritarian opacity, challenging universal assumptions about transparency and participation in sustainability governance.

4.6 Comparative Synthesis: Negotiating Sustainability in Central Asia;

The country-specific analyses of Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, and Turkmenistan demonstrate that sustainability in Central Asia is neither linear nor uniform. Instead, it unfolds as a negotiated paradigm, shaped by the interplay of historical legacies, state discourses, global frameworks, and community practices. This synthesis highlights both convergences and divergences, situating the region within broader debates on sustainability, resilience, and political ecology.

4.7 Shared Legacies, Divergent Paths;

All five republics share a Soviet inheritance of environmental degradation and centralized governance. The collapse of the Aral Sea remains the region's most visible ecological scar, symbolizing the consequences of monoculture and resource mismanagement (Micklin, 2016; Indoitu et al., 2022). At the same time, hydrocarbon dependence, authoritarian governance, and fragile rural economies continue to constrain sustainability transitions (Pomfret, 2019).

Yet trajectories diverge sharply:

- Kazakhstan promotes ecological modernization as a path to global competitiveness, though dependency on hydrocarbons undermines its green rhetoric.
- Kyrgyzstan illustrates resilience from below, where migration and community-based practices fill governance vacuums.
- Tajikistan pursues hydropower modernity, simultaneously advancing clean energy goals while displacing communities and heightening regional tensions.
- Uzbekistan enacts authoritarian reformism, reframing sustainability through agricultural diversification and policy shifts while leaving rural inequalities unresolved.
- Turkmenistan exemplifies sustainability in silence, where state secrecy and hydrocarbon dependency suppress discourse and accountability.

This divergence reflects the plural character of sustainability paradigms, shaped by domestic politics, resource endowments, and international alignments.

4.8 Negotiating Global Frameworks and Local Realities;

Across the region, the Sustainable Development Goals (SDGs) function as both opportunity and constraint. They provide a shared global language for states to articulate progress, attract investment, and signal legitimacy. Kazakhstan's Green Bridge initiative, Uzbekistan's

development strategies, and Tajikistan's hydropower ambitions all borrow from SDG framings (UNDP, 2021).

Yet global frameworks often misalign with local realities. Migration as resilience in Kyrgyzstan and Tajikistan, for instance, remains invisible in SDG metrics. Environmental justice concerns in Uzbekistan's agricultural reforms, or the silences surrounding Turkmenistan's data, illustrate how global indicators risk obscuring lived experiences (IOM, 2022; Freedom House, 2023). This tension underscores the need for interpretive approaches that account for discourse, power, and human-centered practices (Wilson, 2019; Robbins, 2019).

4.9 The Role of Power and Inequality;

Political ecology illuminates the role of power asymmetries in shaping sustainability pathways. In Tajikistan, hydropower projects privilege state narratives of modernity over displaced rural populations. In Turkmenistan, authoritarian control silences both critique and participation. Even in Kazakhstan and Uzbekistan, where sustainability is branded as modernization, political centralization limits grassroots influence.

Meanwhile, inequalities between rural and urban populations exacerbate sustainability divides. Urban centers benefit from targeted reforms and infrastructure, while rural communities contend with degraded soils, salinization, or climate vulnerability with limited state support (Abdullaev et al., 2020; Indoitu et al., 2022). These dynamics show that sustainability in Central Asia is not only about ecological balance but also about social justice, equity, and voice.

4.10 Sustainability as a Negotiated Paradigm;

Taken together, the cases demonstrate that sustainability in Central Asia cannot be reduced to technical reforms or universal frameworks. Rather, it is a negotiated paradigm emerging through:

1. State Discourses: Governments deploy sustainability to bolster legitimacy, project modernity, or manage international relations.
2. Global Pressures: International organizations and development partners shape sustainability agendas through frameworks like the SDGs.
3. Community Practices: Households and communities enact resilience through migration, informal networks, and adaptive livelihoods.
4. Regional Dynamics: Shared water systems, ecological legacies, and geopolitical tensions make sustainability inherently transboundary.

This negotiated paradigm is dynamic, contested, and plural. It highlights Central Asia as a laboratory for sustainability scholarship, where the tensions between modernization, resilience, and political ecology unfold in stark relief.

Broader Implications:

The comparative synthesis offers three key insights:

- Conceptual: Sustainability must be understood not as a fixed model but as a field of negotiation—between modernity and resilience, between state power and community agency, between visibility and silence.
- Empirical: Central Asia demonstrates how global frameworks like the SDGs interact unevenly with local realities, exposing gaps in universalist metrics.
- Theoretical: The region underscores the value of combining ecological modernization, resilience, and political ecology into a plural interpretive framework, advancing global debates on sustainability beyond technocratic solutions.

Ultimately, Central Asia illustrates that sustainability is not a destination but a contested journey, mediated by history, politics, and human agency.

Comparative Analysis Table – Sustainability in Central Asia:

Country	Dominant State Discourse	Key Strategy / Sector	Community-Level Practices (Resilience)	Role Global Frameworks (SDGs, Donors)	Main Challenges & Contradictions
Kazakhstan	Green economy branding; modernization rhetoric	Renewable energy, diversification, “Green Bridge” initiatives	Local environmental activism; coping with urban pollution	Strong alignment with SDGs; uses sustainability for international legitimacy	Hydrocarbon dependency; weak civil society inclusion
Kyrgyzstan	Limited state capacity; fragmented governance	Small-scale agriculture; decentralized adaptation	Migration/remittances; water user associations; informal safety nets	Moderate engagement; resilience largely invisible in global metrics	Climate vulnerability; economic dependence on remittances
Tajikistan	Hydropower modernity; national pride	Mega-projects (e.g., Rogun Dam)	Migration; informal irrigation practices	Framed as clean energy for SDG alignment; donor support for hydropower	Displacement; transboundary conflicts; fragile livelihoods
Uzbekistan	Authoritarian reformism; modernization through agriculture	Cotton reform; diversification; irrigation efficiency	Crop diversification; informal water-sharing; migration	Actively aligns with SDGs and donor frameworks; reform celebrated globally	Persistent water stress; rural inequalities; partial reform implementation
Turkmenistan	State secrecy; hydrocarbon dependency; silence	Natural gas exports; opaque megaprojects	Undocumented/localized practices (little data available)	Formal commitment to SDGs but with no transparency or monitoring	Lack of reliable data; authoritarian opacity; sustainability absent from discourse

Key Patterns from the Table**1. State Discourses Diverge**

- Kazakhstan and Uzbekistan embrace modernization discourse, using sustainability to signal global integration.
- Tajikistan pursues hydroelectric development as both modernity and sovereignty.
- Kyrgyzstan reflects weak governance, with sustainability enacted bottom-up.
- Turkmenistan remains silent, with sustainability discourse largely absent.

2. Community Practices Are Central but Overlooked

- Migration is a cross-cutting resilience strategy (especially in Kyrgyzstan and Tajikistan).
- Informal water-sharing practices sustain rural livelihoods in Uzbekistan and Kyrgyzstan.
- In Kazakhstan, grassroots activism emerges but faces authoritarian constraints.

3. Global Frameworks Provide Legitimacy but Poor Fit

- SDGs provide a shared language, but they often fail to capture lived experiences (migration, inequality, local adaptation).

- Donors support hydropower in Tajikistan and reforms in Uzbekistan but risk reinforcing elite agendas.
4. Contradictions Are Persistent
- Modernization without structural change (Kazakhstan, Uzbekistan).
 - Sustainability framed as progress while deepening inequities (Tajikistan).
 - Silence as political strategy (Turkmenistan).
 - Resilience without recognition (Kyrgyzstan).

5. Theoretical and Conceptual Implications:

The comparative analysis of Central Asia's sustainability pathways reveals that sustainability is neither a neutral nor universal process. Instead, it emerges as a negotiated paradigm, shaped by historical legacies, political discourses, community resilience, and global frameworks. This section situates the findings within broader theoretical debates, demonstrating how the Central Asian experience advances sustainability scholarship in three interrelated domains: ecological modernization, resilience, and political ecology.

5.1 Ecological Modernization and Its Limits;

Ecological Modernization Theory (EMT) posits that environmental reform can be reconciled with economic growth, innovation, and global integration (Mol & Sonnenfeld, 2000; Hajer, 1995). In Central Asia, this framing is most visible in Kazakhstan's green economy strategy and Uzbekistan's agricultural reforms, where sustainability is branded as modernization and as a vehicle for international legitimacy.

However, Central Asia highlights EMT's limits. Despite green rhetoric, Kazakhstan remains heavily dependent on hydrocarbons, while Uzbekistan's reforms reproduce structural inequalities in rural regions. These cases suggest that ecological modernization in authoritarian or hybrid regimes often functions as discursive branding rather than structural transformation (Sharshenova, 2021).

Thus, Central Asia contributes to the EMT debate by showing how sustainability discourse in non-democratic settings is instrumentalized to consolidate state legitimacy rather than to drive systemic ecological reform. It challenges the assumption that modernization trajectories inherently lead to sustainability and underscores the need to interrogate the political uses of sustainability language.

5.2 Resilience as Everyday Adaptation;

Resilience scholarship emphasizes the capacity of communities and systems to absorb shocks, adapt, and transform in response to stressors (Folke, 2006; Berkes & Ross, 2013). Central Asia provides powerful illustrations of resilience from below, especially in Kyrgyzstan and Tajikistan, where households and communities sustain livelihoods through migration, remittances, and informal water-sharing practices.

This broadens the conceptualization of resilience in two ways:

1. Human-centered resilience: In Central Asia, resilience is not merely ecological or technical but deeply social, rooted in care economies, gendered labor, and transnational ties (Bissenova, 2022; IOM, 2022).
2. Invisible resilience: Many adaptive practices—such as informal irrigation agreements or remittance investments in education—remain invisible to global sustainability frameworks, challenging technocratic approaches to measuring resilience.

Central Asia thus expands resilience theory by emphasizing the social and political textures of adaptation, highlighting that resilience is enacted in spaces often overlooked by formal institutions and sustainability metrics.

5.3 Political Ecology and the Power of Silence;

Political ecology stresses that environmental outcomes are inseparable from power relations, inequalities, and discourses (Robbins, 2019). Central Asia vividly illustrates these dynamics:

- In Tajikistan, hydropower projects embody state-led visions of modernity, but displace communities and exacerbate transboundary tensions.
- In Turkmenistan, authoritarian opacity makes sustainability effectively invisible, where silence itself becomes a political strategy to deflect accountability (McCarthy, 2020).
- In Uzbekistan, reform narratives are shaped by international legitimacy and donor pressures, while marginalized rural voices remain muted.

These cases highlight how sustainability is not just contested but also actively suppressed or silenced. Central Asia contributes to political ecology by showing that authoritarian governance does not merely distort sustainability outcomes but also reshapes the very discursive field of sustainability, controlling what can and cannot be discussed.

5.4 Sustainability as a Negotiated Paradigm;

Bringing these perspectives together, Central Asia reveals sustainability as a negotiated paradigm, not a fixed model. It emerges through the intersection of:

- Global frameworks (SDGs as discursive tools and indicators),
- State discourses (modernization, legitimacy, and branding),
- Community practices (resilience, adaptation, and migration),
- Regional dynamics (shared water systems, ecological degradation, and geopolitical tensions).

This negotiated paradigm is plural, contested, and dynamic. It cannot be captured solely by technical solutions or universal frameworks. Instead, it requires interpretive approaches that attend to the historical trajectories, social practices, and power relations that shape sustainability outcomes (Wilson, 2019).

5.5 Broader Theoretical Contributions;

The Central Asian experience advances sustainability scholarship in three key ways:

1. De-centering universalism: It demonstrates the limits of universal frameworks like the SDGs, calling for more context-sensitive, interpretive approaches.
2. Integrating plural theories: It shows the value of combining ecological modernization, resilience, and political ecology into a composite framework, rather than privileging one theoretical lens.
3. Humanizing sustainability: It foregrounds human agency, everyday practices, and lived experiences as essential to understanding sustainability, moving beyond technocratic or state-centric models.

In doing so, the region becomes more than a peripheral case; it serves as a critical vantage point for rethinking sustainability as a dynamic, contested, and human-centered paradigm in global debates.

Conclusion:

Sustainability in Central Asia cannot be reduced to a singular vision or technocratic blueprint. This study has shown that it is better understood as a negotiated paradigm, shaped by the interplay of global frameworks, state-led discourses, community practices, and deeply embedded regional dynamics. While the Sustainable Development Goals (SDGs) offer a shared language of progress, their translation into national and local realities is filtered through distinct historical legacies, political economies, and everyday survival strategies.

The review of scholarship reveals persistent tensions between ecological modernization narratives promoted by governments, resilience practices forged in households and communities, and the political ecologies of water, land, and migration. Each of these

perspectives captures essential dimensions of Central Asia's development trajectory, yet none alone is sufficient. By bringing them together, this research provides a more holistic lens that acknowledges both the structural constraints of authoritarian governance and the adaptive creativity of communities navigating uncertainty.

The analysis also underscores that sustainability in the region is inherently plural and contested. Kazakhstan's "green economy" agenda is as much about global branding as ecological reform; Uzbekistan's agricultural diversification is driven by political calculations as well as food security concerns; Tajikistan's hydropower ambitions embody both national pride and regional friction. At the same time, migration and remittances have become grassroots strategies of resilience, sustaining families while deepening dependency. These dynamics complicate the assumption that sustainability is a neutral or linear process. Instead, it emerges as a dynamic negotiation among actors with unequal power, resources, and visions of the future.

From a theoretical standpoint, this work contributes by synthesizing insights from resilience theory, ecological modernization, and political ecology into a single interpretive framework. This integrated approach helps avoid the reductionism of policy documents that present sustainability as either a technical challenge or a universal pathway. Instead, it foregrounds the messy realities of negotiation, contestation, and adaptation that define Central Asia's encounter with the sustainability paradigm.

For policy and practice, the findings point to the need for greater sensitivity to local contexts, historical trajectories, and political constraints. Regional water governance will remain fragile unless institutions acknowledge asymmetries in power and trust. Climate adaptation strategies will falter if they ignore gendered labor burdens or migration dependencies. Efforts to "green" economies will ring hollow if they prioritize international image over substantive change. Recognizing sustainability as a negotiated paradigm does not provide quick fixes, but it offers a more realistic starting point for dialogue and cooperation.

Finally, this study highlights several avenues for future research. More ethnographic work is needed to capture everyday experiences of sustainability beyond national policy frameworks. Comparative studies across post-socialist regions could illuminate whether Central Asia's negotiated paradigm is unique or part of broader global trends. And closer attention to the role of digital technologies, diaspora networks, and new climate financing mechanisms may reveal emerging dynamics that reshape the sustainability debate in the years ahead.

In conclusion, the Central Asian experience reminds us that sustainability is not a settled script but an ongoing negotiation. It is forged in the contradictions between aspiration and constraint, between global norms and local practices, between state power and community agency. Understanding sustainability in this way humanises the paradigm, situating it within lived realities rather than abstract models. For scholars, policymakers, and practitioners alike, this recognition offers a pathway toward more inclusive and contextually grounded approaches to sustainable development in Central Asia and beyond.

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