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# Navigating urban sustainability: The role of contextual factors and transformative capacities

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ABSTRACT

Cities are central to global sustainability goals, yet evidence on urban transitions skews towards Western democracies. This paper addresses that gap by examining how context shapes urban transformative capacity in Baku, Azerbaijan, a city with a deep oil legacy and centralised governance. Methods comprise a qualitative case study built on thirty-five semi-structured interviews conducted in 2022 with government, civil society, business, academic, and student actors, alongside documentary analysis. The study traces how forms of agency, core development processes, and cross-scale relationships develop together in the urban energy domain. Findings show that long-standing dependence on oil anchors governance norms and public imaginaries, which limits empowered communities and genuinely disruptive experimentation. International drivers, including the Paris climate commitment and the 2015 oil price shock, opened windows for reform and led to new agencies, laws, and pilot projects. Change, however, remains largely top-down. Participation is curated by state institutions, cross-agency coordination is weak, and reflexivity and social learning are limited. Intermediary organisations and international collaborations catalyse activity, but their efforts rarely become routine practice or broaden community autonomy. Empirically, the paper offers among the first systematic assessments of urban transformative capacity in a post-Soviet city. Conceptually, it shows how political regimes and historical legacies shape the link between experimentation, learning, and policy embedding. Practically, it identifies priorities for durable and inclusive transitions: widen civic space and support communities of practice, institutionalise cross-scale coordination and evaluation, align external pressures with domestic enablers, and invest in participatory foresight and locally rooted experimentation. These steps can turn symbolic progress into structural change in Baku and in comparable resource-dependent cities.

## 1. Introduction

Cities are increasingly recognised as critical sites for initiating and accelerating sustainability transitions. As urbanisation intensifies—with nearly 70 % of the global population projected to live in urban areas by 2050 [1]—cities not only concentrate the majority of energy consumption and greenhouse gas emissions but also serve as focal points of policy, innovation, and social mobilisation [2]. Consequently, the capacity of urban systems to undergo transformative change has emerged as a central focus within sustainability transitions research.

A growing body of literature has explored how urban contexts shape the speed and direction of transitions, particularly through socio-technical and institutional configurations [3,4]. Recent contributions within the geography of sustainability transitions have emphasised the uneven spatial dynamics of these processes, asking why transitions emerge in some cities but not others and how place-specific conditions influence transformative outcomes [5]. In this light, the role of contextual factors—including local histories, cultures, actor networks, and governance structures—has become central to understanding transition dynamics [6].

While much empirical research has focused on cities in Western democratic contexts, there is a notable gap concerning post-Soviet cities, where historical legacies, political regimes, and socio-economic structures present unique opportunities and constraints for sustainability transitions. These cities often feature highly centralised governance systems, fossil-fuel dependent economies, and weak civil society participation—factors which pose challenges to the diffusion of grassroots innovations and inclusive energy transitions. Yet, they are increasingly affected by global climate governance and international energy policy shifts, generating tensions and opportunities for change.

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This study seeks to address this gap by investigating how urban contextual factors influence the development of urban transformative capacity (UTC) in post-Soviet settings, with a particular focus on Baku, Azerbaijan. Baku represents a highly relevant case due to its historical role as a global oil capital, its strategic geopolitical position, and its recent engagement with international climate frameworks. It embodies a paradoxical urban energy landscape: shaped by fossil fuel legacy yet increasingly exposed to renewable energy discourse and global decarbonisation pressures. This makes it an ideal setting to examine the dynamics between structural path-dependence and emerging sustainability niches.

The central research question guiding this study is: How do contextual factors enable or constrain the development of transformative capacity for sustainability transitions in the energy sector?

To explore this question, the research adopts Wolfram's (2016) Urban Transformative Capacity (UTC) framework as the main analytical lens. The UTC framework offers a comprehensive approach to assessing cities' abilities to mobilise diverse actors, experiment with innovations, and reconfigure socio-technical systems towards sustainability. It comprises ten interrelated components grouped under forms of agency, core development processes, and relational dimensions. While the framework has been applied in several urban contexts, its application in post-Soviet cities remains limited, prompting the need for empirical validation and theoretical refinement.

This study contributes to the literature in three ways. First, it offers empirical insights into how urban transitions unfold in a politically centralised, fossil-fuel-dependent context. Second, it advances the application of the UTC framework by testing its relevance and limitations in a non-Western setting. Third, it identifies concrete contextual mechanisms—such as intermediary actor roles, historical narratives, and international policy triggers—that shape niche formation and energy governance in Baku.

To achieve these aims, the study adopts a qualitative, case-based approach focused on energy-related sustainability initiatives in Baku. While the detailed methodology is elaborated in the next section, it broadly involves stakeholder interviews and documentary analysis to map actor dynamics, institutional configurations, and the emergence of transformative practices. Rather than offering a linear evaluation of transition progress, the study provides a relational and systemic account of how transformative capacity develops—and is constrained—within Baku's unique urban context.

By focusing on a city often overlooked in transition studies, this research seeks to broaden geographical and political diversity in sustainability scholarship and offer grounded insights into the opportunities and limits of urban energy transitions beyond the global North.

Section 2 outlines the research methodology, followed in Section 3 by the theoretical background that frames the study. Building on this foundation, Section 4 examines the dynamics between Baku's urban context and the formation of urban transformative capacity (UTC), beginning with a review of historical trajectories and the emergence of capacities (4.1) and then considering the triggers for capacity building and development (4.2). Section 5 develops this analysis through a detailed assessment of Baku's UTC, exploring forms of agency (C1–C3), core development processes (C4–C7), and reflexivity, social learning, and relational elements (C8–C10). This leads to Section 6, which applies the transformative capacity assessment to niche formation in Baku. Section 7 discusses the implications of these findings, and Section 8 concludes the paper by summarising the key contributions and acknowledging the study's limitations.

## 2. Methodology

The study employs a case-based research design in Baku, Azerbaijan, to examine the contextual factors influencing niche social activities within local energy policy. Baku's strategic geopolitical location, rapid modernisation, and unique historical context, deeply intertwined with the oil industry, present a distinct setting for exploring sustainability transitions. This historical dependence on fossil fuels significantly influences contemporary energy policies, offering critical insights into the factors enabling or hindering sustainable urban energy initiatives.

Data collection primarily involved semi-structured interviews conducted online from February to August 2022, comprising 35 interviews across five specific stakeholder groups: state actors, third-sector actors, business representatives, experts, and students (Table 1). For the purposes of clarity and confidentiality, interview participants have been anonymised and are referenced throughout the text using the codes V1, V2, …, Vn. The selection of these stakeholder groups was guided by their distinct roles and influences as identified within the urban transformative capacity (UTC) framework [7]. State actors were included to provide insights into the regulatory frameworks, policy-making processes, and governmental influences shaping urban transitions. Third-sector actors, including NGOs and civil society organisations, were selected to capture community perspectives, grassroots activities, advocacy efforts, and their influence on public awareness. Businesses were vital for understanding practical industry-related considerations, barriers, and potential for innovation. Experts were incorporated due to their specialised knowledge and critical insights into the technical and theoretical dimensions of energy transitions. Lastly, students were chosen to reflect the views of future stakeholders, offering perspectives on long-term sustainability aspirations and emerging societal trends.

The sectoral categories shown in Table 1 are derived directly from the detailed interviewee list provided in Appendix A, which outlines individual actor affiliations and roles within each sectoral group.

A cross-sectoral approach was deliberately adopted to capture the multifaceted nature of urban sustainability transitions, which inherently involve complex interactions between diverse actors across various sectors (Table 1). The rationale for incorporating fossil fuel, renewable energy, and non-energy sectors is grounded in the recognition that urban transitions entail systemic interactions that cross traditional sectoral boundaries [7]. Such an approach is essential to understand the broader socio-technical dynamics, identify varied stakeholder perceptions, and delineate the barriers and opportunities related to niche formation and urban energy transitions comprehensively.

Interviewees were selected using a two-step approach: initially, criterion sampling identified participants based on their direct involvement, expertise, and influence in Baku's energy landscape. Criteria included demonstrated leadership, active involvement in sustainability initiatives, and recognised expertise in energy or urban governance. Subsequently, snowball sampling was applied, wherein initial interviewees recommended further participants. This ensured a comprehensive and representative sample of stakeholders and a broad spectrum of viewpoints critical to understanding the complexity of urban transitions.

Interview questions (Appendix B) were structured around a core set of themes derived from the UTC framework, addressing the components of forms of agency, core development processes, and relational dimensions. While a consistent set of standard thematic questions was used across all interviews to ensure comparability, questions were slightly adapted according to each participant's sector, expertise, and role to explore context-specific insights and perspectives effectively.

**Table 1**
Interviewee groups by sector.

| Sector | Actor type | | | | |
|---|---|---|---|---|---|
| | State actors | Non-state actors | | | |
| | | Third sector | Businesses | Students | Experts |
| Fossil fuels | 3 | 1 | | 3 | 1 |
| Renewables | 4 | 5 | 4 | 3 | 2 |
| Non-energy | 1 | 2 | 2 | 4 | |
| Total | 8 | 8 | 6 | 10 | 3 |

Source: own elaboration.

Interview data were analysed through systematic thematic coding using qualitative analysis software (NVivo). The analytical strategy involved an inductive-deductive process, beginning with an initial deductive coding framework based explicitly on the ten interdependent components of the UTC framework, grouped into the three overarching dimensions (forms of agency, core development processes, and relational dimensions). Following this structured framework, coding was refined iteratively through inductive analysis, allowing additional subthemes and insights to emerge organically from the data. This process enabled a nuanced and comprehensive interpretation of recurring themes, mechanisms, and contextual factors influencing urban transformative capacities and niche formation, thus enhancing both the depth and robustness of the analysis.

Documentary analysis complemented the interview findings by providing contextual validation and additional insights. Documents analysed included governmental policy documents, strategic roadmaps, third-sector reports, organisational websites, and relevant news articles selected via systematic content analysis based on explicit criteria, including thematic relevance and consistent search terms. Documentary sources were integrated with interview data through triangulation, whereby key themes identified from interviews were systematically compared and cross-verified with documentary evidence. This process included identifying areas of convergence to reinforce findings and examining discrepancies or contradictions to reveal complexities or limitations in data. By corroborating or contrasting insights across different sources, the documentary analysis enhanced the credibility, contextual depth, and analytical robustness of the study's conclusions.

## 3. Theoretical background

Cities play a pivotal role in sustainability transitions due to their concentration of population, energy use, and greenhouse gas emissions [1,2]. Increasing attention has been placed on urban contextual factors influencing the pace and effectiveness of sustainability transitions [3]. Initially overlooked, spatial configurations and territorial dynamics are now integral to understanding transitions, revealing the significance of geographical contexts and multi-scalar relationships [5,8]. Context-specific factors, including interactions among actors, cultures, institutions, and historical trajectories, significantly shape sustainability transitions [9,10].

This research adopts Wolfram's (2016) urban transformative capacity (UTC) framework as a guiding conceptual lens to assess how urban contexts facilitate or hinder sustainability transitions. UTC is defined as the collective ability of urban stakeholders to initiate, facilitate, and implement transformative changes towards sustainability across multiple complex urban systems [7]. The framework integrates socio-technical transition theories, notably the multi-level perspective (MLP) [24], highlighting the interplay between local innovations and global dynamics. The UTC framework operationalises urban transformative capacity through ten interdependent components grouped into three dimensions as illustrated in Table 2: (1) forms of agency, (2) core development processes, and (3) relational dimensions.

The forms of agency dimension include inclusive governance (C1), transformative leadership (C2), and empowered communities (C3). Inclusive governance emphasises the participation of diverse stakeholders and the role of intermediaries facilitating governance networks. Transformative leadership spans multiple sectors, advocating systemic change. Empowered communities refer to autonomous groups actively participating in planning and implementation [7].

Core development processes encompass systemic awareness (C4), sustainability foresight (C5), disruptive experimentation (C6), and innovation embedding (C7). Systemic awareness involves recognising path dependencies and systemic barriers critical for identifying strategic points of intervention [11]. Sustainability foresight includes developing collective visions and scenarios for transformative change. Disruptive experimentation relates to innovative practices challenging established

**Table 2**
Components and development factors of urban transformative capacity [[37], p.127, Table 1].

| Component | Definition | Factors |
|---|---|---|
| C1 Inclusive and multiform urban governance | Diversified, flexible, and robust governance structures with wide participation and active inclusion of stakeholders from all sectors in a diversity of governance modes and actor networks with sustained and effective intermediary organisations and individuals among sectors and domains. | C1.1 Participation and inclusiveness<br>C1.2 Diverse governance modes and network forms<br>C1.3 Sustained intermediaries and hybridisation |
| C2 Transformative leadership | Polycentric and socially embedded leadership arises not only from political elites but also from other spheres of society. A kind of leadership that enhances the role of different agents of change and includes the transfer between discourses (across sectors, domains, scales) and the articulation of new visions and discourses to leverage collective energies and enable social learning. | |
| C3 Empowered and autonomous communities of practice | Communities of practice are built on the shared experience of urban place and/or joint concerns. They require association, coalition forming, access to resources, and conditions of autonomy. | C3.1 Addressing social needs and motives<br>C3.2 Community empowerment and autonomy |
| C4 System(s) awareness and memory | Awareness and understanding among stakeholders of the system dynamics, path dependencies, and obduracies that undermine urban sustainability. | C4.1 Baseline analysis and system(s) awareness<br>C4.2 Recognition of path dependencies |
| C5 Urban sustainability foresight | A collective vision of radical departure from the current path should be created, including alternative scenarios based on systems thinking. Transformational knowledge must be developed through transdisciplinary co-production. | C5.1 Diversity and transdisciplinary co-production of knowledge<br>C5.2 Collective vision for radical sustainability changes<br>C5.3 Alternative scenarios and future pathways |
| C6 Diverse community-based experimentation with disruptive solutions | Practical experimentation of path-deviant initiatives in the urban setting is crucial to develop transformative knowledge and social learning. | |
| C7 Innovation embedding and coupling | The extent to which barriers to innovation practices are removed and their embeddedness in routines, organisations, plans, and legal frameworks is enhanced. | C7.1 Access to resources for capacity development<br>C7.2 Planning and mainstreaming transformative action<br>C7.3 Reflexive and supportive regulatory frameworks |
| C8 Reflexivity and social learning | Reflexivity and learning must include all actors of change to enable positive feedback loops. This involves the application of reflective assessment | |

(continued on next page)

**Table 2** (*continued*)

| Component | Definition | Factors |
|---|---|---|
| | methods, the creation of formal and informal reflexivity formats that critically question progress, and to systematic management of transformational knowledge. | |
| C9 Working across human agency levels. | Capacity development needs to occur at different agency levels simultaneously, addressing individuals, households, groups, organisations, networks, as well as society at large. | |
| C10 Working across political-administrative levels and geographical scales | Cross-scale and multi-level implications should be incorporated into the understanding of all the components of the framework. Interactions among scales and administrative boundaries must be considered. | |

norms [12]. Innovation embedding represents mechanisms integrating sustainability innovations into mainstream urban policy and practice [2].

Relational dimensions consist of reflexivity and social learning (C8), human agency levels (C9), and multi-scalar interactions (C10). Reflexivity and social learning imply ongoing critical evaluation and adaptive processes within urban transitions. Human agency involves engagement at individual, organisational, and societal levels, whereas multi-scalar interactions emphasise coordination across different geographical and administrative scales [11].

The UTC framework emphasises the necessity of inclusive governance structures, transformative leadership across sectors, community empowerment, systemic awareness, and reflexive social learning to effectively drive urban transitions [7]. This framework informs the empirical investigation by guiding data collection and structuring the analysis around its specific components, enabling the assessment of how these dimensions manifest and interact within the context of Baku. Specifically, the research systematically evaluates each UTC dimension through qualitative methods, including stakeholder interviews and documentary analysis. By aligning the analytical approach with the UTC framework, this study aims to identify concrete mechanisms and contextual factors that either facilitate or constrain niche formation and sustainability transitions in the city.

To capture the complexity of urban sustainability transitions, the analysis also draws on broader transition literatures. Insights from socio-technical systems highlight the interdependencies between technologies, institutions, and actors [9,10]. Studies on path dependencies clarify how historical trajectories and institutional legacies shape current capacities, while multi-scalar dynamics illuminate the interactions between global, national, and local processes [9]. Thus, while UTC provides the central analytical structure, the inclusion of complementary perspectives enhances the explanatory power of the study and allows for a more nuanced understanding of Baku's transition dynamics.

## 4. Dynamics between Baku's urban context and UTC formation

### *4.1. Previous historical trajectories and the emergence of capacities*

This section explores how past events and ideologies have triggered the formation of urban transformative capacities. Analysing main triggers is important as they provide insights into path dependencies, institutional configurations and agencies that play an essential role in Baku's sustainability transitions. C1 to C10 refer to the 10 key components of the UTC framework. To aid readability, key UTC components (C1 to C10) are fully summarised in Table 2.

The energy system, particularly oil and gas, is seen as a vital aspect of the city's past, heritage, and character, both at the public and government levels. This symbol of identity exists alongside an enduring recognition of the need to safeguard fossil legacies and current energy systems. The city's history and image are intimately connected to its energy development over time. This connection illustrates how path-dependence shapes collective identity and governance norms. In Baku, oil is not merely a resource but a cultural and institutional anchor that continues to influence perceptions of economic progress and policy direction. A senior officer expressed a deeply rooted oil legacy in Azerbaijan as below:

> "Historically and psychologically, we as Azerbaijanis are so used to the idea that we are one of the countries to produce oil. We are like Marco Polo for oil, and that is why I think we are quite comfortable with the oil-based economy. Because it is the generations and generations, and there is no real change in this kind of mindset that we now have"
>
> (V8).

This statement encapsulates how deeply ingrained fossil fuel dependency is in both public discourse and institutional memory. Such cultural framing creates resistance to imagining alternative energy futures, thereby slowing the mobilisation of urban transformative capacities like sustainability foresight (C5) and reflexivity (C8).

In contrast, renewable energy is considered a "new question." While there is a broad understanding of deteriorating environmental conditions throughout society, clean energy is not perceived as linked to Baku's past or character. Consequently, both informal and formal institutions in Baku's energy system demonstrate a strong path dependence.

The significance of historical trajectories and path dependence in this research is evident, as they significantly affect the modes of agency by which actors work to transform the city. Furthermore, the prominent Soviet legacies, confirmed by a majority of interviewees, make path dependence even more pertinent to this study (V1; V3; V4). Historical dependencies in Baku manifest unevenly across UTC components. While they strengthen certain capacities—such as systemic awareness (C4)—they simultaneously constrain others, like empowered communities (C3) and disruptive experimentation (C6), which require deviation from established norms.

The idea of path dependence aids in understanding the extent of public involvement in decision-making, inclusivity, governance forms in the city, and the restricted presence of practice communities. Thus, the significance of past historical trajectories in shaping the formal and informal institutional contexts where urban transformative capacity arises is emphasised once more. Developing path-deviant activities necessitates grasping experiences, meanings, history, and identity related to a specific location [6]. As a result, cultural and historical variances are vital in shaping local narratives about the future, which are instrumental in mobilising actors and reinforcing locally specific processes that influence urban transformative capacity.

The most engaged actors in Baku's energy policy transition process are intermediary actors who have generated informal energy governance spaces (C1), facilitated networking and social learning (C8), contributed to the formation of a vision for clean energy futures (C5.2), and supported the development of disruptive initiatives that shaped niches (C6). In Baku, a diverse array of intermediary actors plays pivotal roles in various sectors. These include initiatives by major entities such as British Petroleum (BP), which is significantly involved in the energy and environmental sectors. Additionally, the EU4 Environment program, under the umbrella of the European Union, contributes to sustainable environmental practices. The European Youth Parliament

(EYP) engages young people in political and social debates, fostering a sense of european identity and understanding among youth. The Student and Youth Organisation of Azerbaijan is pivotal in mobilising and empowering the younger demographic towards active civic participation. Moreover, the Society of Petroleum Engineers (SPE) provides a crucial platform for professionals in the petroleum industry to exchange knowledge, technology, and practices about the energy sector. Collectively, these actors contribute to a dynamic and multifaceted landscape of initiatives in Baku, spanning environmental sustainability, youth empowerment, and professional development in the petroleum sector. Local and international intermediary actors have facilitated the development of social movements around environmental issues. However, many of these intermediaries are international or elite actors, which may limit their ability to generate bottom-up, locally rooted transformative change. Their initiatives, while symbolically important, often lack deep integration with Baku's urban communities, suggesting a weak link with C3 (empowered communities of practice).

In democratic settings, where the majority of transition studies have been conducted thus far, informal spaces have been found to foster the development of formal governance. For instance, according to the literature, informal and decentralised governance is crucial in the initial phase of a transition, while at more advanced stages, formal and centralised governance becomes necessary [13]. However, given Azerbaijan's less democratic nature, it is widely acknowledged by interviewees that the national policies established by the government since 2015 (stemming from the oil price drop and the international commitments under the Paris Agreement) have altered the local "rules of the game" and, as a result, the conditions and institutional settings navigated by various actors to develop new objectives and facilitate transformative change (V18; V20; V24; V33) [14]. This highlights a key tension in the application of UTC in non-democratic contexts: while informal governance spaces do exist, their ability to scale up or embed within formal governance structures remains limited. This reinforces the need to adapt UTC assumptions to local political realities.

In the case of Azerbaijan, the government serves as the element linking all components of the theoretical model (UTC) and, consequently, dictating the conditions that shape the specific form that urban transformative capacity components adopt in the interplay between global trends, local identities, history, and the city actors' aspirations (V10). Literature emphasises the significance of creating opportunity contexts to enable transformative capacity [15]. In this regard, this research highlights the importance of national government policies in establishing a favourable context and effectuating systemic transitions [16] through the local integration of multi-dimensional urban changes [17] and allowing for (sub)system reflexive governance spaces [3] that facilitate collaboration between actors from diverse action domains and innovation fields [18].

Although the emergence of informal governance in Baku fundamentally differs from that in Western contexts, it is still consistent with C1 inclusive and multiform urban governance, as stated in UTC. However, assuming that civic engagement and social movements were non-existent and did not contribute to niche development in Baku would be inaccurate. Behind this formal governance lies 60 years of civic engagement that began in the 1960s and 1970s, creating "informal eco-coalitions" [19]. These ecology-driven protests contributed to the strength of social capital [20] and the development of sustainable disruptive initiatives that helped shape contemporary niches and deviate from the existing pathways. This aspect is reflected in the UTC through C3 empowered and autonomous communities of practice, recognised as an accelerating component of the transition. Despite these historical roots, the lack of continuity between past civic activism and current environmental movements indicates a failure to embed long-term civic memory into transformative governance structures (C1.3). This suggests a fragile civic infrastructure vulnerable to regime shifts.

Unfulfilled social needs alone are insufficient for social movements; a commitment to ideological change to the status quo is also necessary to achieve the desired outcomes [21]. Such ideologies unite actors and cultivate practical grassroots innovations based on reorganised priorities and alternative values. In Baku, the ideologies of embracing clean energy and environmental protection were adopted roughly eight years ago, from the landscape (oil price plunge), which illustrates a specific dynamic within the urban transformative capacity framework. This feature distinguishes Baku's UTC formation from other regions, demonstrating the link between global and local scales as an accelerant of the energy transition. This connection is also seen through the impact of globalised capitalism, dominant individualistic and consumerist lifestyle aspirations, and increased awareness of environmental problems' consequences, which contradict the communitarian collectivism [21] that typifies alternative energy niche visions.

The findings of this research suggest that Baku's contextual factors are highly significant, as they influence the urban transformative capacity components of the socio-technical system. Moreover, these factors are essential for understanding the various urban transformative capacity components in Baku, particularly those related to forms of agency and core development processes like existing network strength, resource access, institutional thickness, types of intermediaries, diverse spaces for inclusive governance, the emergence of shared transformative leadership, and the cultivation of systemic awareness and urban foresight. For instance, Participant V4 explains Baku's strong networks and resource access with the presence of a profitable oil industry in the city. Similarly, Participant V26's comments about environmental events organised by big corporations such as Coca-Cola and Pepsi illuminate the presence of intermediaries and the spaces for inclusive governance in Baku.

By revealing the private sector's focus on well-being in Baku, this study highlights the validity of considering social commitment as a component of UTC. Although private sector actors lack a collective nature, they possess a strong social commitment aligned with social and solidarity economies. However, since disruptive sustainable initiatives originating from international corporations do not resonate with local identity, purpose, and belonging, the private sector encounters difficulties in engaging and retaining participants and forming alliances and networks. Moreover, scepticism towards outsiders, mainly Western corporations, inherited from the closed Soviet model, further hinders the private actor's involvement in the process.

> "I do not think the private companies also care about this much."
>
> (V34)

Despite the challenges stated by participants V4 and V34, the role of private corporations in creating visions and contributing to energy transitions was acknowledged by several respondents.

> "I see that even big corporations, for example, Coca-Cola or Pepsi, have net-zero action plans. And they organise some kinds of events, for example…cleaning the shore of plastic. It is a good event to engage the public in such kinds of activities, and at the same time, raise awareness of people who may not know about such threats as climate change."
>
> (V26)

While initiatives by corporations like Coca-Cola and Pepsi — such as beach cleanups and public awareness campaigns — demonstrate engagement with sustainability, it is important to critically assess the motivations and impacts of such activities. These corporations have been widely criticised for greenwashing and are consistently ranked among the top global plastic polluters. Their sustainability branding efforts often fall short of addressing their broader environmental footprints. Therefore, while their involvement may contribute to raising awareness in Baku, it must be understood within the context of corporate image management rather than systemic environmental transformation.

In summary, Baku's historical trajectories have created a dual dynamic: they have endowed the city with strong systemic awareness and institutional resources (C4, C7.1), but have also entrenched hierarchical governance models and limited civic engagement. This duality presents both assets and barriers for transformative capacity development, underscoring the need for critical adaptation of transition frameworks in post-Soviet urban contexts.

This subsection has explored Baku's historical trajectories and their influence on the formation of UTC. Having established the foundation of UTC in Section 4.1, Section 4.2 will investigate the triggers for capacity building and capacity development, further elaborating on the dynamics that shape Baku's transformative capacities.

### 4.2. The triggers for capacity building and capacity development

Building upon Section 4.1, Section 4.2 examines specific triggers for capacity building and capacity development in Baku. Understanding these triggers is critical for identifying moments of structural opening — when otherwise rigid or centralised systems become temporarily flexible and receptive to change.

The approval of the Paris Agreement was pinpointed as the primary catalyst for capacity building, illustrating how landscape-level energy macro-policies impact city transitions and shape the UTC. As noted by key stakeholder V1 during the interview process, the Paris Agreement has significantly altered the government's policy orientation. By joining the Paris Agreement in 2016, the nation pledged to reduce GHG levels by 35 % by 2030 [22]. Consequently, to fulfil these obligations, the adoption of clean energy and the engagement of multiple stakeholders are planned. Participant V20's commentary corroborates the analytical framework, noting the government's commitment to the Paris Agreement and a shift in the government's perception of the fossil industry towards a more inclusive and integrated "energy system", which is more relevant for implementing sustainable policies. Notably, the establishment of the Azerbaijan Renewable Energy Agency (AREA) and the implementation of strategic roadmaps for renewable energy underscore the city's strategic redirection from its oil-dominant energy regime. These initiatives not only showcase the government's forward-thinking approach but also highlight the significant role of policy innovation in fostering niche formation and path creation. Therefore, these landscape pressures laid the foundations for establishing inclusive and effective energy governance (C1) in Baku. This illustrates how external, global mechanisms can shape local transformation, but only when paired with national political will. The agreement alone would not have catalysed transition without concurrent shifts in government commitment, suggesting that landscape triggers must align with regime-level enablers to activate UTC components.

The realisation of NDCs (nationally determined contributions) under the Paris Agreement was further driven by the 2015 oil price drop, which sent shockwaves to both the government and society [14]. Energy policy changes, underpinned by the oil price decline, are identified as the primary regime-level milestone that prompted the emergence of specific capacities. As Participant V6 mentioned, "after 2015, the government started putting more emphasis on energy transition". Before the energy policy change and the signing of the Paris Agreement, clean energy and environmental niches fell under a dispersed local social network with minimal acceleration. However, more inclusive governance processes (C1) have created synergies between new and diverse actors (V2; V6; V22), which appear to be speeding up transition processes through the strengthening of existing transition capacities and the development of new ones, such as shared leadership (C2) and the nascent integration of new legal frameworks for coupling innovation (C7).

The interaction between economic disruption (oil price decline) and international obligation (NDCs) catalysed a recalibration of state priorities. This moment reinforced capacities related to inclusive governance (C1), shared leadership (C2), and innovation embedding (C7), albeit in early or partial forms. It exemplifies how crises can serve as incubators for systemic change — but only when strategically harnessed.

Moreover, additional capacities can be fostered through international agreements—especially those that bring external expectations, funding, and opportunities for technical collaboration—by enhancing systemic awareness (C4), promoting social reflection and learning (C8), and supporting the development of a shared sustainability vision (C5.2). These agreements — such as the Paris Agreement — influence national policy priorities, provide legitimacy to sustainability goals, and incentivise inclusive governance structures. In this context, international factors act as landscape-level pressures that shape the local environment for capacity development, making them one of the most influential contextual drivers in Baku's energy transition. Yet, these shifts remain largely top-down, with limited horizontal diffusion to non-state actors. This raises the question of whether externally triggered change can genuinely empower transformative capacity, or whether it risks recentralising sustainability narratives under a state-led paradigm [3].

To identify triggers at the niche level, it is important to consider the various interpretations of "sustainability" that coexist and impact the transformative capacity of the city. According to the UTC framework, the emergence of shared values and principles plays a catalysing role in niche formation. In recent years, the growing consensus among local actors on the need to progress towards a production model based on renewable energy has been observed in Baku. As noted by respondent V12, "There is a cultural shift toward sustainability in Baku". Therefore, it is this shared understanding, increased awareness levels and top-down support that have triggered the niche development in the city. Findings from the present study indicate that the role of actors and their agencies is a vital contextual factor influencing and promoting specific conceptions, principles, or values essential for niche formation and broader societal transitions [23]. The emergence of sustainability values among local actors signifies a soft cultural shift — a necessary but insufficient condition for transformation. Without structural changes to decision-making processes, these normative changes risk becoming symbolic rather than operationalised through new institutions or practices.

This scenario of policy adaptation and stakeholder engagement in Baku illustrates a classic example of path creation in the realm of sustainable urban development. By strategically aligning its policies with international agreements such as the Paris Agreement, Baku is not merely responding to external pressures but is actively forging a new trajectory towards sustainability. This deliberate move away from traditional fossil fuel reliance towards an integrated energy system embodies the essence of path creation, where innovative approaches and collaborative governance pave the way for transformative change in urban energy landscapes.

Within the MLP framework, Baku's niche social activities are recognised as critical engines for path-creation and mindful deviation. By acting as incubators for radical innovations, niches propose alternative models that challenge and potentially overhaul the existing energy regime. From the implementation of grassroots renewable energy initiatives to the advocacy for green urban policies, these activities exemplify how the alignment of diverse actors, alongside the development of new technologies and policies, can catalyse significant shifts in the urban energy landscape. An example of niche activities catalysing urban transformation in Baku is the burgeoning grassroots movement focused on urban greening and sustainability. Clean city movement, for example, has initiated community-driven urban gardens and local recycling initiatives, creating a paradigm shift in community engagement with environmental stewardship. By mobilising local communities towards sustainability, these initiatives not only challenge the existing energy consumption patterns but also seed the ground for alternative, sustainable urban living models. Similarly, Baku's innovative local energy policies, such as the 'Green Building' codes and incentives for solar panel installations, diverge from Azerbaijan's traditional oil-centric energy policies. These policies illustrate a commitment to sustainable urban planning and energy efficiency, laying new pathways for the city's

energy transition. Integrating these examples into the narrative demonstrates how niche social activities and policies in Baku serve as key triggers for capacity building, underscoring their role in the city's path creation towards sustainability.

Overall, Baku's transition trajectory is driven less by gradual internal evolution and more by punctuated, externally catalysed events, such as the oil price drop and international climate commitments. These triggers created strategic windows for recalibrating urban energy governance. However, the mobilisation of transformative capacity has been uneven: while institutional structures have adapted, deeper shifts in participation, leadership, and experimentation remain fragile. This underscores the importance of not just identifying triggers but understanding their scope, longevity, and ability to foster durable systemic change across all levels of the UTC framework. These findings pave the way for the next section, allowing for a more nuanced understanding of Baku's UTC.

## 5. Baku's urban transformative capacity (UTC) in detail

### *5.1. Forms of agency (C1 to C3)*

Having explored the emergence of UTC in Baku in the previous section, this section unpacks the interplay between governance, leadership, and communities of practice, highlighting not only the presence or absence of these forms of agency but also their internal contradictions, uneven development, and implications for niche formation. Rather than treating each component in isolation, the analysis draws connections between them to reveal systemic dynamics in Baku's transition landscape.

Comprehensive and diverse urban governance (C1) serves as the primary nucleus of the urban transformative capacity framework (UTC). It was seen as underdeveloped in Baku by most interviewees (V11; V14; V24; V25; V26) with restricted spaces and methods of energy governance (C1.2). Nevertheless, the creation of AREA and the passage of the "Renewable Energy Law" in 2021 facilitated participation from various sectors and on different levels (C 1.1). To further emphasise the efforts being made in Baku's energy transition, an expert interviewee provided their opinion on the activities being undertaken:

> "We work diligently to raise awareness and engage people. We also focus on small-scale projects, such as installing rooftop panels, and collaborate with the EBRD. This means we interact with individuals and strive to increase awareness
>
> (V13).

This development emphasises the formation of new governance forms, which fit within the UTC analytical framework and help to understand some of the dynamics in Baku's energy transition. Opinions were more mixed regarding the sub-component of sustained intermediaries and hybridisation (C1.3). While crucial hybrid intermediary roles were identified within the governance shaping process, they faced challenges in executing their function on a broader scale (V2). These sub-components (C.1.1–C.1.3) would determine effective governance [7]; however, in the case of Baku's clean energy policy, both due to its recent formation and the existence of historical dependencies (V5), the effectiveness of the energy governance space is debatable. The three sub-components of inclusive governance — stakeholder participation, diverse governance modes, and intermediary roles — appear unevenly developed. While participation is increasing (C1.1), hybrid governance forms (C1.2) and sustained intermediation (C1.3) remain embryonic. This imbalance creates an implementation gap: actors may be present, but mechanisms for coordination and learning are still underdeveloped.

In theory, transformative leadership (C2) communicates visions and is distributed across various sectors — private, social, administrative, academic, and political — at different levels, with a dedication to systemic change for sustainability [7]. Most interviewees described these characteristics, but none specifically mentioned transformative leadership. Initially, interviewees commonly associated the concept of leadership with a pyramidal hierarchy that relies on one person or sector, focusing on public policy. Participant V26 emphasised limited collaboration among actors as a challenge for transformative leadership:

> "The Ministry of Ecology and Natural Resources organise events, but they also could collaborate because the climate change issue cannot be resolved by a single entity. Multi-stakeholder cooperation with the public, the community, and the indigenous population is necessary"
>
> (V26).

This quote underscores that leadership in Baku tends to remain confined within institutional mandates rather than acting across boundaries. Instead of transformative leadership as defined by [7]—distributed, multi-level, and vision-driven — Baku displays managerial or project-based leadership that lacks strategic integration. The notion of systemic change is rarely embedded in leadership discourses, which constrains long-term transitions.

However, recently leadership in Baku has begun to engage diverse participants in the decision-making process. For example, the Ministry of Ecology and Natural Resources routinely organises meetings with the public to address and discuss environmental concerns. Some actors instigate institutional change by acting as intermediaries, transitioning from social activism to institutional roles. This corresponds with the relational dynamics outlined by [25], which describes forms of agency that effectively achieve institutional change, such as transformational leadership, involving actors who occupy multiple positions, change positions and/or develop boundary relationships [26,27]. On the other hand, if essential stakeholders do not develop these forms of agency and interaction, the potential for urban transition and actual change inevitably remains restricted [28]. These individual efforts mirror emerging forms of agency but are often disconnected from broader structural mechanisms. In this sense, C1 and C2 overlap; intermediaries function as informal leaders, but without institutional recognition or formal channels, their influence remains diffuse.

The analysis revealed that there are very limited communities of practice (C3) in Baku. However, two interviewees stated that some communities of practice exist, but they mainly address social and economic needs (V20; V27). A participant who attended an event hosted by the Student and Youth Organisation—a volunteer-driven, third-sector entity focused on addressing economic and social issues in Azerbaijan—shared their experience:

> "So that's the only thing related to renewable energy that I have participated in at the community level… But we were not talking about renewable energy there, we were mostly focusing on two other SDGs related to gender equality and equal education, accessible education for everyone."
>
> (V33)

This shows that while civic initiatives exist, they are only indirectly linked to energy or environmental sustainability. In the context of Baku, such initiatives play a vital role in building social cohesion, enhancing equity, and addressing immediate livelihood concerns, which are all foundational dimensions of sustainability. However, their thematic separation from energy and environmental agendas indicates a fragmented sustainability landscape, where socio-economic and ecological domains evolve in parallel rather than in synergy. This suggests that while civic energy and social commitment are present, they have not yet converged around a shared sustainability vision encompassing both social well-being and environmental transformation. In Baku's setting, this disconnection also reflects local priorities, where addressing economic vulnerability and social inequality constitutes an essential precondition for any durable transition towards low-carbon urban futures. Therefore, rather than viewing these initiatives as absent from

sustainability, they should be understood as addressing the social base upon which broader energy transitions may eventually depend.

Community empowerment and autonomy (C3.2) are discovered to be nearly non-existent in Baku, with only limited examples of consumer groups, student organisations, or a few NGO initiatives. As a result, limited public interest, top-down support, and intermediaries suggested additional challenges for the development of transformative capacity in this final component of the framework. This lack of empowered communities reflects broader structural barriers — such as limited funding mechanisms, regulatory constraints, and a state-centric model of development — that prevent bottom-up agency from translating into long-term institutional change. In contrast to cities where informal networks evolve into formal governance platforms, Baku's context keeps such evolution restricted.

The urban transformative capacities (UTC) and insights from evolutionary economic geography (EEG) offer a comprehensive lens through which the potential of niche activities for path-creation in Baku can be fully appreciated. The spatial dynamics and institutional arrangements unique to Baku, as outlined by EEG, significantly influence the emergence and development of these niche activities. Whether it's leveraging the city's historical ties to energy production or capitalising on its strategic geopolitical position, niche activities are effectively creating new paths that challenge the status quo. For instance, the empowerment of communities (C3) and the fostering of innovative urban governance models (C1) serve as catalysts for path-creation, challenging existing regimes and encouraging the development of sustainable urban practices. Supported by the UTC framework, these activities harness Baku's capacity for transformation, illustrating how urban areas can become crucibles for sustainable innovation.

In sum, Baku's forms of agency reveal a mixed picture: governance structures are evolving but remain uneven and centralised; leadership is emerging but lacks the transformative orientation necessary for deep change; and community empowerment is aspirational rather than actualised. These findings reflect a broader dynamic in post-Soviet urban contexts, where the state remains the primary actor, and alternative sources of agency are only partially integrated into the transition process. Importantly, the fragmentation across C1 to C3 weakens the systemic cohesion of transformative efforts and limits the potential for cumulative capacity building. Recognising and addressing these asymmetries will be essential for deepening transition pathways in Baku. These findings set the stage for the next Subsection, 5.2, which delves into 'core development processes,' providing another layer to the general understanding of Baku's UTC and its impacts on niche formation.

### *5.2. Core development processes (C4 to C7)*

This section will investigate various elements of core development processes, such as system awareness, urban sustainability foresight and community experimentation. While each component is explored individually, attention is paid to its interlinkages and mutual reinforcement or contradiction. This allows for a more systemic interpretation of how core development processes operate within Baku's urban energy transition.

C4 system(s) awareness and memory: According to findings, baseline analysis and system(s) awareness (C4.1) are present within the key development group. However, this understanding has not extended to the entire group of energy stakeholders in the city. Evidenced by a quote from respondent V3:

> "If he is a person in the field, he is knowledgeable; otherwise, the awareness is lower."
>
> (V3)

This observation reveals a selective distribution of systemic awareness (C4.1), concentrated within technical and professional actors. This creates an uneven capacity landscape, where expert knowledge exists but lacks horizontal diffusion to broader stakeholder groups — a key requirement for fostering collective learning and participatory foresight. The variable awareness and expertise within different stakeholder groups in Baku help to explain the slow energy transition dynamics.

Recognition of path dependencies (C4.2) is relatively strong among respondents, indicating an awareness of the institutional and historical constraints shaping Baku's energy system. However, this awareness has so far translated into only small-scale actions and limited strategic interventions (V1; V5; V6; V7). Expert interviewees stated that while there is systemic awareness of path dependencies and institutional inertias, they have been considered and acted upon on a small scale so far (V2; V6; V10). While awareness of path dependency is essential, it does not automatically lead to action unless accompanied by a shared vision of alternative futures (C5.2). Baku's case illustrates a common pitfall in transition contexts — recognising structural lock-ins without mobilising forward-looking strategies to escape them.

C5 urban sustainability foresight: According to interview data and documentary analysis, it can be concluded that diversity and transdisciplinary co-production of knowledge (C5.1) are weaknesses in the country. Knowledge about the energy system is not yet open-source and widely shared, making collective consciousness weak, as various actors have not been actively involved in constructing knowledge about systemic dynamics and relations. However, the potential of governance spaces to carry out strategic knowledge management and enable transfers among different forms of knowledge has been suggested, as well as the necessity of developing territorial sustainability foresight with the active involvement of all stakeholders in the city (V6; V35).

Likewise, the collective vision for radical sustainability changes (C5.2) is present in a minority of groups – namely, social movements and experimental communities - but it does not extend to the majority of actors. In short, there is a strong lack of collective vision and uncertainties around the energy transitions among the populous. Scepticism and difficulty in imagining a sustainable future were expressed by various participants during the interview process. For instance, one respondent expressed scepticism towards energy transitions as follows:

> "Firstly, there is scepticism around renewables and their efficiency. Is it going to be beneficial for us?"
>
> (V33)

Another respondent echoed this sentiment by stating that:

> "I think that is very difficult to imagine for people…."
>
> (V5)

Together, these quotes signal a cognitive gap between problem diagnosis and future-oriented imagination. While some actors recognise the urgency of change, their inability to project alternative scenarios (C5.3) limits the generative capacity of the transition process. This suggests a weak coupling between C4 (system memory) and C5 (foresight), which hinders proactive, long-term planning.

However, there are some grassroots voluntary initiatives by citizens, notably the "Təmiz Bakı" (Clean Baku) movement, which brings people together to clean beaches and raise awareness about environmental pollution. Beyond cleanup efforts, they organise events and distribute informational flyers to educate the public about renewable energy sources, energy conservation techniques, clean cooking methods, and related topics. Related to C5.2, the absence of a shared path (C5.3) is one of the main weaknesses in Baku due to a lack of collaboration and knowledge exchange among various actors. Initiatives like Clean Baku indicate the early seeds of sustainability foresight rooted in local civic action. However, their limited institutional support and episodic nature mean they currently function as isolated practices rather than embedded foresight mechanisms within urban planning.

C6 diverse community-based experimentation with disruptive solutions. Interviewees indicated that clean energy experimentation in Baku is not yet widespread, and existing experiments are primarily implemented by external actors such as international organisations and large

corporations (V9; V10; V11; V15). Although the energy system is growing in terms of innovative initiatives, actor diversity and the number of experiments remain limited. Various respondents emphasised that local administrations should reduce bureaucratic requirements for new initiatives and be more open to collaboration (V21; V28; V29). However, despite indications of change, barriers and difficulties have persisted thus far. This highlights a key limitation in C6 development — the presence of experimental projects is not synonymous with transformative experimentation. Without mechanisms for reflection, scaling, and integration into mainstream systems, these initiatives risk remaining tokenistic rather than disruptive.

C7 innovation embedding and coupling. While innovative initiatives in the energy system are increasing, there are significant challenges in embedding them and coupling them with public policies. In this regard, specific initiatives launched by external actors in partnership with local municipalities are particularly relevant for advancing public administration mechanisms to incorporate innovative practices. However, according to the analysis of various documents and assessments of the interviews, it can be concluded that comparatively high resource access in Baku (C7.1), both for promoting innovation in the energy sector and for planning and mainstreaming transformative action (C7.2), creates a conducive environment for niche development (V20; V21; V30).

While Baku's access to oil-generated financial and institutional resources has supported infrastructure development, innovation funding, and capacity-building efforts, this should not be interpreted as suggesting that natural resources are necessary for transformative capacity formation. In fact, reliance on natural resource wealth can create path dependencies and institutional inertia that hinder sustainability transitions. What matters more is how available resources—regardless of origin—are mobilised, distributed, and governed to support inclusive, innovative, and adaptive transition processes. Thus, while oil wealth has facilitated certain capacities in Baku, it has also posed challenges, making resource access a context-dependent enabler, not a universal prerequisite. This duality reflects a central paradox: the same financial and institutional resources that enable experimentation and pilot initiatives also reinforce regime stability and delay structural change. Unless resource use is reoriented towards inclusive and long-term innovation, capacity development risks becoming superficial.

Concerning reflexive and supportive regulatory frameworks (C7.3), the processes for adjusting regulatory frameworks that support innovations are slow and bureaucratic (V2; V6; V8). The challenge of innovation, embedding, and coupling experienced in Baku is evidenced by the following quotes:

> "The system is not open to innovation… Moving towards renewables or the innovation process, all these kinds of things are slow."
>
> (V2)

This perception is symptomatic of institutional inertia and regulatory rigidity, both of which constrain innovation embedding (C7.3). While external actors may push for experimentation, the lack of responsive governance structures limits their long-term integration and transformative impact.

In summary, Baku's core development processes show selective capacity development — system awareness (C4) and experimentation (C6) are emerging but largely confined to elite or external actors; foresight (C5) and innovation embedding (C7) remain weak and fragmented. The lack of synergy among these components constrains the city's ability to move from recognising problems to imagining, trialling, and embedding solutions. The weak feedback loops between experimentation and regulation, and between knowledge and vision, illustrate a disconnect between capacity components that ideally should be mutually reinforcing. These findings suggest that developing deeper, more integrated pathways for learning and collaboration will be key to enabling effective transitions in Baku. The insights garnered from this section set the stage for the subsequent section, which provides the final layer of UTC by investigating reflexivity, social learning, and relational elements.

### *5.3. Reflexivity, social learning and the relational elements of urban transformative capacity (C8 to C10)*

By focusing on the last layer of the UTC, this section will complete the analytical framework and provide a full picture of Baku's capacity for urban transformation.

C8 reflexivity and social learning. The research indicates that reflexivity, social learning, and relational elements are apparent weaknesses in Baku's urban transformative capacity. Concerning reflexivity and social learning, the energy systems require specific improvement strategies to investigate positive feedback loops and critically reinforce and enhance policies, programmes, and initiatives. To shed light on why reflexivity and social learning are seen as weaknesses in Baku's urban transformative capacity, expert interviewees assert that it is a new development and something to observe.

> "Because we are pretty new and … there are a lot of gaps…
>
> (V2)

This self-assessment reveals a transitional stage in which reflexivity is acknowledged as desirable but remains underdeveloped. Actors are aware of gaps, yet the mechanisms to systematically evaluate, question, and adapt energy strategies (core to C8) are still emerging. This gap illustrates a broader pattern of latent but untapped capacity.

Highlighting the need for creating spaces for reflexivity and learning, another respondent explained:

> "But for them, it is also how to create the institutions and favourable ground for these ideas to be cultivated, developed, and supported."
>
> (V8)

Here, reflexivity is framed as a structural condition — something that must be "created" rather than assumed. This reveals an important nuance: reflexivity is not just a behavioural trait, but a function of institutional design, time, and space for deliberation, which are largely absent in Baku's current governance model. Despite those challenges, due to the presence of particular spaces of encounter in Baku, there is a clear intention to monitor and evaluate the local strategy in ways that enable social learning and reflection.

Various studies reveal the coexistence of various sustainability conceptions in a particular area that impact both experimental processes and governance restructuring. It is crucial to understand how these different perspectives are negotiated and coordinated, which account dominates, and who promotes these changes [29]. In the context of energy, the analysis highlights that the creation of formal governance spaces is not the only critical factor, but the ability of actors to create partnerships around specific projects with other actors who do not necessarily share the same sustainability perspective is also essential. This is exemplified by energy social organisations collaborating with mainstream companies to address energy poverty.

This dynamic illustrates an unresolved tension between alternative and mainstream sustainability narratives. While UTC assumes a degree of convergence through social learning, the Baku case shows a fragmented landscape where competing definitions of sustainability (economic vs. environmental, centralised vs. participatory) hinder integration.

The use of UTC helped to identify the government's role in creating spaces and pre-established conditions for these dynamics of confrontation and collaboration to occur is crucial for generating alliances between different actors and reinforcing the relational fundamentals of urban transformative capacity, as previously noted. Yet, these encounters often occur within tightly curated spaces, which limit their transformative potential. When reflexivity is institutionalised as consultation rather than co-creation, the risk is that it reproduces dominant power

structures rather than challenging or reshaping them.

C9 working across human agency levels. The data identified a range of efforts at different human agency levels. This validates the 'working across human agency levels' aspect UTC framework, as it reveals a complex interplay of actors in Baku's energy transition. Some examples at the individual level include an increase in conscious energy consumption and production. Illustrating efforts at the individual level, one interviewee shared:

> "I am trying to do it myself. I'm trying to sort the garbage that I'm using, then trying to save on energy… And I am trying to inform the people about the project, the importance of this waste, energy process, because it is very important."
>
> (V31)

Awareness is also growing at the level of families and households. Another participant highlighted the significance of environmental factors at the family and household levels by saying:

> "This is our country, this is where my parents live… my future is there… I have people that I love, and they live there; the environmental condition has a really big impact on their life expectancy."
>
> (V35)

These reflections suggest that while individual agency is growing — particularly among youth and professionals — collective or meso-level agency (e.g. neighbourhood initiatives, civic alliances) remains marginal. This skew towards individualisation of responsibility reflects broader neoliberal patterns of transition governance that shift burdens onto consumers while avoiding structural transformation.

This also reflects a disconnection between communities of practice (C3), relational learning (C8), and horizontal governance (C10). Without institutional platforms that link individual agency to collective and political scales, transformative capacity remains fragmented and difficult to scale.

Most interviewees agree that the component of working across political-administrative levels and geographical scales (C10) is inadequate, as there is limited coordination between political and administrative levels, both horizontally and vertically, emphasising limited coordination between various levels of government, participant V28 stated:

> "Also, I think there is a lack of cross-sectoral collaboration in Azerbaijan. For example, different organisations and ministries do not like cooperating or working together on any project. They see each other as competitors"
>
> (V28)

This example underscores that administrative silos — a legacy of Soviet governance — persist across levels and sectors. The lack of vertical and horizontal coordination not only slows decision-making but also undermines systemic coherence, a necessary precondition for scaling innovation and embedding transition pathways.

Therefore, it is essential to create a shared vision to achieve the energy transition goals. However, creating a shared vision remains a challenge in Azerbaijan. For instance, previous studies have documented institutional conflicts, where overlapping mandates and conflicting responsibilities among government agencies have led to environmental concerns being downplayed [30]. As stated by an expert interviewee, this challenge persists to date:

> "Ministry of Energy, for example, might have a different agenda. I think there might also be some sort of competition between them. So, the things that the Ministry of Energy is doing, SOCAR might not like them."
>
> (V2)

This points to entrenched power asymmetries that undercut coordination. State-owned enterprises and ministries often act in self-interest, resisting cross-sectoral alignment. This behaviour is inconsistent with the UTC principle of multi-scalar alignment (C10), which requires a culture of collaboration, not competition.

Although there is a shortage of policy goals aimed at achieving coordination and governance at a larger geographical level, some positive developments are taking place in Baku. Providing an example of government collaboration, an interviewee stated:

> "We did it in collaboration with the government. So, they gave us some good suggestions… And since we had the connection with the Renewable Energy Agency and the Minister of Energy, it was easier."
>
> (V4)

While this example shows that collaborative governance is possible, it remains the exception rather than the norm. Successful coordination appears dependent on personal connections or individual initiative rather than institutional routines — a sign of weak procedural integration.

Overall, Baku's relational capacities (C8–C10) are weak, fragmented, and inconsistently applied. Reflexivity exists as aspiration rather than practice, social learning occurs in isolated spaces, and coordination across levels remains limited by legacy governance models. Although individual awareness is rising, structural pathways to link that agency to institutional change are underdeveloped. The persistent absence of reflexive, multi-actor, and cross-scalar governance means that systemic learning and alignment — critical to long-term transition success — remain elusive. This not only limits the effectiveness of other UTC components but also threatens the durability of emerging transition initiatives in Baku. Having provided a detailed understanding of Baku's urban transformative capacities, the next section will explore the dynamics between urban transformative capacities and niche formation in Baku.

## 6. Transformative capacity assessment for niche formation in Baku

In Section 5, the core components and relational elements of Baku's urban transformative capacity were provided. This section, however, shifts the focus to the influence of urban transformative capacities on the niche formations in Baku. This shift is instrumental in order to connect existing transformative capacities to tangible mechanisms of change (niche formation) in the urban context. Rather than treating niche activities as isolated outputs, this section assesses how deeply they are embedded in the urban system, how well they draw upon and reinforce UTC components, and whether they represent incremental improvements or signals of systemic transition. The aim is to evaluate the degree to which Baku's niche initiatives challenge existing regimes or become co-opted within them. Additionally, the empirical evidence gathered from Baku's foray into niche social activities reveals a compelling narrative of path-creation. Instances such as the successful integration of solar energy solutions in urban infrastructure and the mobilisation of community-led environmental conservation efforts stand as a testament to the city's evolving energy landscape. These examples not only provide concrete evidence of path-creation but also showcase how niche activities in Baku are not just responses to immediate challenges but catalysts for broader systemic changes. Based on the interviews and documentary analysis, the summary provided above regarding Baku generally pertains to the agency and interaction patterns, growth methods, and relational aspects found in the transformative capacity framework. This highlights the city's evolving strategy for energy transitions and already takes into consideration the fundamental capacity strengths and weaknesses. The subsequent paragraphs discuss the primary assessment outcomes and highlight crucial learnings.

National regulations' role in shaping the energy system's governance appears to be a crucial contextual factor affecting the niche formation in

Baku. Official bodies view stakeholder participation as a requirement rather than a potential advantage. As a result, the variety of actors in central decision-making processes is limited, and the focus of initiatives for inclusion is placed on public awareness, knowledge dissemination, and educational initiatives. Therefore, the existence of the state-centric model is identified as one of the primary challenges in Azerbaijan's transition to renewable energy. As interview respondents aptly noted:

> "I think the key barriers are the way I see is that Azerbaijan's approach to developing renewables is still state-led…it's like the state sees itself as a key and only actor somehow."
>
> (V8)

This reveals a governance paradox: while state-led efforts can provide stability, legitimacy, and direction, they often stifle the very experimentation and multi-actor engagement required for deep transition. The dominance of state actors limits the diversity of visions and actors that are typically essential in robust niche formation.

While the existence of a state-centric model is identified as one of the primary challenges, this does not imply a lack of governmental initiative or progress. On the contrary, the Azerbaijani state has implemented several progressive policies, such as the green building codes and the establishment of institutions like AREA (Azerbaijan Renewable Energy Agency). However, the challenge lies in the dominance of the state in steering the transition, which often limits independent agency, decentralised innovation, and multi-directional governance. Many stakeholders expressed that while participation exists, it is often curated or controlled by state actors, thereby constraining the full potential of inclusive, reflexive, and bottom-up governance processes that are crucial for accelerating sustainability transitions. This form of state-led engagement, while significant, still reflects a hierarchical governance model that may not fully leverage the potential of intermediary actors, grassroots experimentation, or empowered communities.

As noted already, energy governance continues to adhere to a top-down method, even though engagement practices have already begun to shift in Baku. Nevertheless, intermediation proves to be a vital facilitator in the city. This is already apparent through the state-led awareness campaigns that promote civic engagement. A broader and more inclusive public participation takes place in Baku due to the presence of various organisational structures, such as NGOs (V33). Despite the lack of consistent funding, NGOs enable impartial and trustworthy mediation, effective community empowerment, and the incorporation of diverse knowledge and values in Baku (V8). The findings indicate that NGOs play a critical role in niche formation by fostering community empowerment and public awareness, a vital element of the UTC framework (C1). However, these non-state actors operate within constrained civic and regulatory spaces. Their role is more compensatory than transformative — filling in gaps left by the state rather than driving structural change. This illustrates a weak feedback loop between civic experimentation and institutional embedding (C7).

Moreover, the involvement of various stakeholders, including private companies, NGOs, and academic institutions, in renewable energy projects reflects a collaborative effort towards achieving Baku's sustainability goals. For instance, the 'Clean Energy Baku' initiative, a collaborative project between local universities, NGOs, and international partners, focuses on raising public awareness about renewable energy benefits and implementing small-scale renewable energy solutions in urban areas. Such collaborative efforts are pivotal in creating new pathways for energy transition, emphasising the role of niche activities in driving systemic change. By weaving these examples into the assessment, we can comprehensively understand how Baku's urban transformative capacities facilitate niche formation, paving the way for innovative solutions and systemic transformations in the city's energy landscape. While collaborative projects like 'Clean Energy Baku' reflect growing awareness and engagement, their transformative potential remains limited by scale, replicability, and institutional follow-up. Without integration into city-wide strategies, such initiatives risk remaining isolated "best practices" rather than catalysts of systemic change.

Leadership is of significant importance in the city, but it is often not transformative. The national government sets ambitious goals and provides strong political guidance, but these objectives are either overly aspirational or not fully realised. A gap in transformative leadership in Baku hinders the city's capacity for change and as evidenced by interview participants:

> "But I am a bit sceptical about the capacity to meet those targets. I am a bit worried that these plans will not be materialised because they are either too ambitious or the way they will be materialised will not be what we were expecting…
>
> (V8)

This speaks to the performative nature of leadership in Baku, where ambitious targets are announced without the institutional follow-through or cross-sectoral coordination to realise them. It reflects the existence of discursive support for transition without accompanying structural change. Furthermore, such leadership lacks sensitivity to complex sustainability issues and the diverse interests of affected stakeholders, failing to engage in collaborative decision-making.

In Baku, the presence of academic institutions (institutional thickness) serves as an essential contextual factor that impacts the development of urban transformative capacity for niche formation. Institutional thickness refers to the presence, density, and interaction of diverse institutions—such as governmental bodies, universities, and civil society organisations—that contribute to shaping and reinforcing local development or transition processes [31]. Students and individual scholars from private or newly established universities initiate alternative approaches, while scholars from established academic institutions may obstruct change efforts. Generally, scientific research and collaboration on sustainability transitions are mainly absent in the country. "Academic research on the environment in Azerbaijan is newly emerging" [32,p.5]. Participant V8 criticised the educational system in the country as a significant barrier to change:

> "So, another obstacle is, of course, Azerbaijan does not have the educational system, we do not have the level of scientific innovation…
>
> (V8)

These findings also reveal a key deficiency in the UTC and niche dynamics framework's human capital and knowledge exchange component (C2.1).

Communities of practice and their related empowerment strategies are still in the early stages of development. Given the recent emergence of clean energy adoption, dedicated communities are scarce and, if present, have initially formed in other domains (particularly social issues). Efforts for participation have not yet effectively equipped these communities with new skills and resources that support self-organisation and autonomy. This pattern reflects a systemic misalignment across UTC components: while material resources exist (C7.1), they are not matched by enabling conditions like empowered communities (C3), experimentation (C6), or long-term visioning (C5). As a result, niche formation is underpinned by strong infrastructure but weak agency. However, interview findings suggest that the implementation of community empowerment programs and increased resource access in Baku has positively impacted the city's communities of practice. These findings also highlight the overly centralised economic structure of Azerbaijan, which has put Baku at the forefront of the transitions.

Systems thinking (C4) and awareness of corresponding dynamics and resistances concerning urban energy form a particularly weak point in Baku. The prevailing focus has been on routine policy instruments for either reducing demand (information, incentives, regulation) or

increasing supply within the given energy system configuration. However, analyses that would help to reveal the de-/stabilising systemic role of technologies, infrastructures, actors, institutions, and practices are not undertaken. In Baku, systemic understandings could only be recognised for individual stakeholders in research and civil society, while civil servants hardly question the status quo. This tendency can be attributed to institutional inertia inherited from the Soviet legacy, where hierarchical, top-down governance structures discouraged critical thinking and autonomous decision-making, leading to a bureaucratic culture that prioritises compliance over innovation. This also helps to explain the existence of the limited number of niche activities in the city. As stated by an interview respondent, societal resistance to change hinders energy transition efforts.

> "Our people are not very open to novelties, and they are kind of scared to change the status quo in any topic, therefore in the energy sector."
>
> (V20)

This resistance is not merely cultural but also political. A risk-averse bureaucratic culture, inherited from the Soviet legacy, reinforces status quo practices and discourages the experimentation and dissent that characterise successful niche development.

Regarding sustainability foresight (C5), the city follows a comprehensive vision to direct collective efforts. However, these visions do not stem from an extensive deliberative process and convey varying value orientations – sustainability is not explicitly addressed. Moreover, the city has yet to employ scenario or back-casting methodologies of any sort, including systemic ones. This means that crucial learning opportunities regarding the long-term feasibility and appeal of solutions are left untapped. It also suggests that stakeholder identification with these visions is generally weak. The below quote emphasises the absence of a comprehensive, long-term vision for sustainability.

> "We don't have evidence-based policymaking. For instance, strategic thinking about what is going to happen in 20 or 30 years with the rise of renewable energy and the decline of the oil and gas sector."
>
> (V35)

This highlights a lack of anticipatory governance — the capacity to envision and prepare for future transitions. In Baku, forward-looking policy appears as rhetoric, not embedded practice. Without scenario planning or participatory foresight, transition initiatives risk being reactive rather than strategic.

Nonetheless, Baku has begun diverging from this trend by adopting various programmes such as "Azerbaijan 2020: Look into the Future", which envisions the participation of energy consumers, the private sector, and academia [14]. Yet, despite these initiatives, the energy transition has not become a vision for Baku, with energy being considered part of a plan targeting urban competitiveness and economic growth.

Experimentation holds a significant role in the city, but it is neither acknowledged as such nor genuinely disruptive. It is noticeable that local stakeholders are, for the first time, taking on distinct roles and engaging in innovative activities related to energy and the environment. However, most initiatives remain highly traditional, with innovation not being a primary goal and lacking indicators to evaluate processes, outcomes, and impacts consistently. Experiments that somewhat deviate from this pattern arise only when NGOs and academia take a more proactive stance by collaborating with intermediary actors. Following these attributes of experimentation, the embedding of innovation is neither facilitated nor has it significantly taken place thus far. As mentioned by multiple respondents, innovation within the city remains disconnected, disjointed, and inadequately integrated (V2; V3; V8; V6; V26). Despite the initial hesitance of authorities to allow alterations to the existing energy system, a change in regulation and policy support, such as subsidies and consulting, has been observed in Baku (V14).

Baku adopted not only novel regulations that modify market conditions for PV (photovoltaic), for example, but also created new energy-related entities and interaction formats, targeting different types of change and providing institutional support. The below quote refers to the critical component of the UTC framework (governance and policy change C1.2), emphasising the accelerating speed of reforms as a result of new regulatory mechanisms.

> "I would say that it has been accelerated during the last couple of years, especially after the establishment of the energy regulator in December 2017… Before that, reforms were kind of slow."
>
> (V14)

This acceleration underscores the importance of institutional timing: windows of opportunity (e.g. post-crisis or leadership change) can create momentum but sustaining that momentum requires institutionalisation — something that remains fragile in Baku's case.

Considering the characteristics mentioned above, the variety of institutions and actors actively participating in niche formation and, consequently, in the energy transition process is generally limited. Dominant organisations in both the public and private sectors, as well as some universities, hold sway, while households, smaller businesses, and individual citizens tend to take on a more passive function. Furthermore, broader social networks and associations continue to be peripheral players, even though the implementation of recent programmes in Baku that are targeting more extensive participation appears promising. The quotes below support the intermediaries and civic engagement element (C1.3) of the UTC framework, highlighting a lack of engagement by non-governmental players.

> "And apart from the government, are there any other actors that are actively engaged in this process of promoting renewable energy? So, I think while we see some policy discourse on behalf of some of the government agencies, we don't see much social input in this process."
>
> (V8)

Regarding scale levels, urban energy governance in Baku evolves solely at the city scale, encompassing local authorities, industry, and academia, with policies aimed at firms and households. Overall, the city demonstrates a significant shortfall in considering larger scales, such as urban-regional, infrastructure networks, or national levels, as evidenced by the following:

> "Economic and social disparities among Azerbaijani cities pose another challenge. Baku, the capital city, contributes 70% of the GDP due to the oil and other business sectors. Simultaneously, the majority of tax collection and investments are generated by Baku. A delay in economic diversification, the lack of structural changes in the economy, and persistent human capital gaps between urban and rural populations [33] have led to this difficult situation. The disparity in income-generating capacities between Baku and the rest of Azerbaijan is another issue that needs addressing." [34]

Reflexivity and social learning (C8) are relatively weak in the city. Although Baku generates various new opportunities for discussing energy policy and involving multiple stakeholders, collective reflexivity and social learning are more of an emerging side effect than an outcome of a structured approach. There is a lack of awareness regarding the necessity for regular, cooperative, and systemic progress evaluation and its integration into a broader process of societal deliberation and strategy development. This also indicates a lack of ongoing scientific support. Under these circumstances, governance learning remains largely single-loop, tending to perpetuate past cultures, structures, and practices. The quote from participant V14 refers to social capital and adaptive capacity (C2.2) and highlights the rigid mindset that resists learning change as a significant barrier to the transition.

"They do not want to learn new things… They have been doing the same thing for the last 30 years or 40 years, and they are not willing to improve anything."

(V14)

Based on the evaluation of the transitional capacities of Baku's energy system, it can be inferred that nearly all capacities remain underutilised, offering room for improvement. Conversely, Baku's contextual factors were recognised as the primary catalysts for transformative capacity development. The analysis supports the niche dynamics aspect of the adopted framework by showing that niche formation in Baku is limited and in its initial development stage; however, due to heightened landscape pressure, shifts in government energy policy, and increased public awareness, a substantial rise in niche development has been observed. The central roles of intermediaries (C1.3), inclusive and diverse governance (C1), addressing social needs and motivations (C3.1), and systemic awareness and memory (C4) in niche formation were underscored as necessary forms of collective agency that mutually promote capacity growth [35].

Furthermore, the findings suggest that components of urban transformative capacity are influenced by a range of contextual factors that not only determine actors' capacity to pursue their sustainable disruptive aspirations but are also a specific outcome of their collective agencies. Therefore, it is fair to conclude that the relationship between contextual factors and transformative capacities are interconnected, as both have recursive dynamics that can reinforce each other. Contextual factors are defined as the processes that generate transformative capacities, which then lead to favourable contextual factors for capacity development.

The relationship between urban transformative capacities and contextual factors can be visualised as a feedback loop. For example, existing context, such as the socio-political environment, economic conditions, historical precedents and cultural nuances, provides a favourable condition upon which transformative capacities emerge. Once these capacities emerge, they can influence and shape the context from which they emerged. The main components of the UTC framework, such as roles of intermediaries (C1.3), inclusive and diverse governance (C1), addressing social needs and motivations (C3.1), and systemic awareness and memory (C4) in niche formation, not only passively emerge from the existing context but also actively influence and shape it. As literature reflects, their existence and activities illustrate the importance of collective agency in promoting capacity increase [36].

These recursive dynamics can be observed in Baku's urban landscape as well. For instance, the state-led awareness-raising campaigns have resulted in promoting and increasing civic engagement in the city (V3). As a result, the growth of NGOs is observed, which play an instrumental role in fostering community empowerment and public awareness. These NGOs, on the other hand, lead to changes in the context by advocating for more inclusive and diverse decision-making processes (V4; V35). This example illustrates how transformative capacities and contextual factors continually shape and redefine each other in Baku, creating an evolving landscape of change.

Overall, niche formation in Baku remains at an embryonic stage, characterised by experimentation without deep institutional embedding. While state actors have enabled early steps through policy and investment, their dominance limits diversity and decentralisation, essential features of resilient niche ecosystems. Non-state actors and civil society contribute to awareness-raising but often lack the autonomy or influence to reshape systemic priorities. The mismatch across UTC components — between infrastructure and agency, between vision and coordination — constrains the development of transformative niches. In this sense, Baku's trajectory reflects a hybrid transition model: simultaneously moving forward and reinforcing existing structures. The challenge ahead lies in turning symbolic progress into structural transformation.

## 7. Discussion

This study contributes to the literature on urban transformative capacity (UTC) and sustainability transitions by unpacking how these processes unfold within a unique post-Soviet, resource-dependent context. In doing so, it provides key empirical insights and theoretical reflections that contribute to a deeper interpretive understanding of the mechanisms shaping urban energy transitions in Baku, Azerbaijan. This discussion section reflects on the core findings and distils them into broader contributions to sustainability transitions research, particularly around the role of context, governance, and institutional path dependencies.

A central insight emerging from the study is the importance of historical and cultural path dependencies in shaping current perceptions, governance arrangements, and transition capacities. The embeddedness of fossil fuel identity in both societal values and institutional memory presents a major barrier to envisioning alternative energy futures. This aligns with existing scholarship on socio-technical lock-ins but adds a cultural and symbolic dimension, showing how identity narratives can inhibit the development of foresight (C5) and reflexivity (C8). The finding that Baku's legacy of oil production influences public mindsets and policy preferences exemplifies the challenges of fostering disruptive experimentation (C6) in contexts with deeply rooted extractive histories.

Furthermore, the findings underscore the uneven development of UTC components across Baku's urban governance landscape. While there is emerging capacity in areas like inclusive governance (C1.1), innovation embedding (C7.1), and niche experimentation (C6), these are often fragmented and externally driven. For example, initiatives by multinational corporations and international organisations play a pivotal role in piloting renewable energy and awareness campaigns. However, these efforts are often perceived as externally imposed, raising concerns about legitimacy and cultural resonance. This illustrates a gap in community empowerment (C3) and suggests that local ownership and bottom-up agency remain limited.

Another major contribution of this research lies in its illumination of the limitations of applying the UTC framework in non-democratic or centralised governance settings. Unlike the pluralistic, multi-actor environments assumed in many UTC applications, Baku's state-centric model concentrates decision-making power in government hands, creating structural barriers for inclusive governance (C1.2), transformative leadership (C2), and cross-scalar coordination (C10). This finding advances the theoretical literature by highlighting the need to adapt UTC assumptions to account for regime type and political centralisation. It also raises critical questions about how transformative capacity can be built in contexts where civic space is constrained and state actors dominate the transition narrative.

The study also identifies important contributions regarding the role of landscape-level triggers in catalysing transition dynamics. The 2015 oil price drop and Azerbaijan's commitments under the Paris Agreement acted as key turning points that spurred institutional reforms, strategic foresight, and policy innovation. However, while these external shocks created windows of opportunity, their impacts were mediated through national-level political will. This underscores the interdependence between landscape pressures and regime alignment for effective UTC mobilisation, reinforcing insights from the multi-level perspective (MLP) literature.

Despite the emergence of new institutions such as the Azerbaijan Renewable Energy Agency (AREA) and the introduction of progressive regulations like the Renewable Energy Law, the study finds that structural reforms are yet to be matched by corresponding shifts in participatory governance and civic agency. Intermediary actors—especially NGOs and academic institutions—are beginning to play a role in enabling niche formation, but their influence is constrained by limited funding, regulatory barriers, and a lack of formalised collaboration mechanisms. These findings call for a reconceptualisation of

intermediaries not just as connectors or facilitators, but as actors navigating complex and often hostile political landscapes.

Another critical insight is the cognitive and cultural disconnection between systemic awareness (C4) and sustainability foresight (C5). While actors across sectors demonstrate an understanding of path dependencies and environmental risks, this has not translated into shared visions or long-term planning frameworks. The absence of participatory scenario development and collective visioning suggests a weak integration between knowledge production and governance. This gap inhibits the mainstreaming of sustainability narratives and the embedding of innovations (C7) into policy and practice.

Moreover, the findings reveal a paradoxical role for resource wealth in Baku's transition dynamics. While oil revenues provide financial and institutional resources that enable infrastructure development and experimental initiatives, they also reinforce existing power structures and delay structural reforms. This complicates the narrative that resource abundance can be leveraged for sustainability and highlights the need for strategic resource governance that prioritises inclusive, forward-looking investment.

In terms of niche development, the study shows that while several grassroots and corporate-led initiatives exist—such as Clean Baku and corporate clean-up drives—their transformative potential is limited by scale, replicability, and institutional follow-up. These initiatives often lack formal integration with broader energy transition strategies, leading to isolated successes rather than systemic change. This finding resonates with critiques of sustainability transitions as being overly focused on technological experimentation without adequate attention to institutional embedding and social inclusivity.

The research also draws attention to the limited development of relational capacities (C8–C10), particularly reflexivity, social learning, and cross-scalar coordination. Fragmented governance, institutional silos, and weak inter-ministerial collaboration were repeatedly identified as barriers to system-wide learning and alignment. Although examples of individual agency and localised innovation exist, these remain disconnected from formal policy frameworks and lack mechanisms for scaling up.

In sum, this study advances the literature on urban sustainability transitions by providing an empirically rich and theoretically informed analysis of UTC formation in a politically centralised, resource-dependent context. It highlights the uneven development of UTC components, the critical role of historical and institutional path dependencies, and the importance of adapting theoretical frameworks to local political and cultural realities.

In doing so, the research also reflects on the validity and applicability of Wolfram's (2016) urban transformative capacity framework in a non-Western setting. While the framework proved analytically valuable for structuring the analysis, certain components—particularly those assuming decentralised governance, empowered communities, and reflexive learning—require reinterpretation in state-centric contexts such as Baku. This suggests that transformative capacity can manifest through hierarchical or state-led mechanisms rather than the network-based forms typically emphasised in Western applications, underscoring the need for contextual adaptation when extending the framework globally. Recognising these dynamics not only refines the theoretical reach of the UTC framework but also strengthens the study's broader argument for locally grounded and context-sensitive approaches to urban transformation.

## 8. Conclusion

This study has demonstrated that sustainability transitions in Baku are deeply shaped by its unique socio-political history, institutional legacies, and state-centric governance model. By employing the urban transformative capacity (UTC) framework, the research identified both the enabling and constraining factors that define Baku's energy transition landscape. While notable strides have been made—such as the establishment of AREA, adoption of clean energy legislation, and increased experimentation by NGOs and private actors—progress remains uneven. Capacity components like systemic awareness (C4), innovation embedding (C7), and multi-scalar coordination (C10) are emerging but fragmented, while others, such as transformative leadership (C2), empowered communities (C3), and reflexive learning (C8), remain underdeveloped.

The findings highlight a transition pathway heavily driven by top-down, exogenous triggers—such as the Paris Agreement and the 2015 oil price shock—rather than internal momentum or grassroots mobilisation. While these triggers have spurred niche developments and policy realignments, their sustainability is threatened by entrenched hierarchies, institutional inertia, and limited civic agency. The disconnect between strong regulatory aspirations and weak implementation mechanisms underscores a governance paradox, where state ambition is not matched by multi-actor participation or systemic integration.

To advance Baku's sustainability transition, future research should explore three critical areas. First, a comparative analysis with other post-Soviet cities could yield insights into how authoritarian legacies condition UTC components differently across geographies. Second, more granular, longitudinal studies are needed to trace how niche activities evolve, scale, and interact with dominant regimes over time. Third, further investigation into the role of informal civic networks, youth movements, and digital platforms may reveal latent capacities currently overlooked in formal governance structures.

Ultimately, unlocking Baku's transformative potential will require deliberate efforts to democratise sustainability governance, build participatory foresight mechanisms, and reorient state-led strategies to more inclusive and adaptive models. Only by embedding transition processes in local cultures, values, and communities can Baku move beyond rhetorical commitment to genuine systemic change.

## CRediT authorship contribution statement

**Pinar Langer:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

## Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used Chat GPT 5 and Grammarly in order to improve the readability and language of the manuscript. After using this tool, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the published article.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A. Interviewee List with Sector and Actor Type

| Interviewee | Affiliation & Role | Date | Sector | Actor Type |
|---|---|---|---|---|
| V1 | Renewable energy expert, a local private company | April 2022 | Renewables | Expert |
| V2 | Energy expert, the governmental entity | February 2022 | Fossil fuels | State |
| V3 | Senior Official, an energy company | May 2022 | Fossil fuels | Business |
| V4 | Junior officer, an international company in Baku | February 2022 | Fossil fuels | Student |
| V5 | Researcher, a higher education institute in Finland | June 2022 | Renewables | Business |
| V6 | Researcher, a higher education institute in Azerbaijan | May 2022 | Non-energy | Third sector |
| V7 | Junior officer, an international company in Baku | March 2022 | Renewables | Student |
| V8 | Head of school, a higher education institute in Azerbaijan | August 2022 | Non-energy | Third sector |
| V9 | Energy student, a higher education institute in Azerbaijan | February 2022 | Fossil fuels | Student |
| V10 | Student, a higher education institute in Azerbaijan | February 2022 | Non-energy | Student |
| V11 | Junior officer, an international company in Baku | April 2022 | Fossil fuels | Business |
| V12 | Junior manager, a local private company | March 2022 | Renewables | Business |
| V13 | Head of the department, the governmental entity | March 2022 | Fossil fuels | State |
| V14 | Project manager, a regional organisation | February 2022 | Renewables | Third sector |
| V15 | Energy Student, a higher education institute in Azerbaijan | March 2022 | Renewables | Student |
| V16 | Senior officer, an international company in Baku | March 2022 | Fossil fuels | Business |
| V17 | Renewable energy expert, a local private company | May 2022 | Renewables | Expert |
| V18 | Researcher, a higher education institute in Finland | February 2022 | Non-energy | Third sector |
| V19 | Junior officer, an international company in Baku | February 2022 | Fossil fuels | Business |
| V20 | Senior officer, an international company in Baku | June 2022 | Fossil fuels | Student |
| V21 | Senior officer, an international company in Baku | July 2022 | Fossil fuels | Business |
| V22 | Manager, a third sector organisation in Azerbaijan | February 2022 | Renewables | Third sector |
| V23 | Junior officer, an international company in Baku | February 2022 | Fossil fuels | Student |
| V24 | Senior officer, a third sector organisation in Azerbaijan | February 2022 | Non-energy | Third sector |
| V25 | Senior officer, a third sector organisation in Azerbaijan | March 2022 | Non-energy | Third sector |
| V26 | Junior officer, the governmental entity | May 2022 | Renewables | State |
| V27 | Senior officer, the governmental entity | March 2022 | Renewables | State |
| V28 | Officer, a third sector organisation in Azerbaijan | March 2022 | Renewables | Third sector |
| V29 | Junior officer, an international company in Baku | March 2022 | Renewables | Business |
| V30 | Student, a higher education institute in Azerbaijan | July 2022 | Non-energy | Student |
| V31 | Senior officer, the governmental entity | March 2022 | Non-energy | State |
| V32 | Junior officer, an international company in Baku | July 2022 | Renewables | Business |
| V33 | Senior officer, the governmental entity | March 2022 | Renewables | State |
| V34 | Senior officer, an international company in Baku | June 2022 | Fossil fuels | Expert |
| V35 | Researcher, a higher education institute in Azerbaijan | May 2022 | Renewables | Third sector |

## Appendix B. Sample Interview Questions

A. Forms of Agency

Inclusive and Multiform Governance (C1)

- In what ways are different stakeholders (government, businesses, NGOs, citizens) involved in shaping energy-related urban policies?
- Are there platforms or spaces where cross-sector collaboration occurs? If so, how effective are they?

Transformative Leadership (C2)

- Who do you see as key leaders or champions driving energy transition efforts in Baku?
- Do these leaders promote a shared vision across different sectors or communities?

Empowered Communities of Practice (C3)

- Are there community groups or grassroots initiatives actively contributing to the energy transition or sustainability in Baku?
- What level of autonomy or influence do these communities have in shaping policy or practice?

B. Core Development Processes

System Awareness and Memory (C4)

- How would you describe public and institutional awareness of the systemic challenges in Baku's energy system?
- To what extent is there recognition of historical dependencies in current urban planning or energy governance?

Sustainability Foresight (C5)

- Is there a shared long-term vision or scenario for a sustainable energy future in Baku?
- How are different knowledge systems and actors involved in developing such visions?

Disruptive Experimentation (C6)

- Are there any recent examples of pilot projects or experimental initiatives challenging the status quo in the energy or sustainability field?
- What enables or hinders such experimentation?

Innovation Embedding and Coupling (C7)

- What efforts exist to scale up or institutionalise successful sustainability innovations?
- Are there regulatory or organisational mechanisms that support or resist embedding change?

C. Relational Dimensions

Reflexivity and Social Learning (C8)

- How are lessons learned from past policies or projects captured and applied in new initiatives?
- Are there processes for regularly reviewing and improving policies based on feedback?

Working Across Human Agency Levels (C9)

- How are individuals, communities, and institutions mobilised or engaged in the transition process?
- Are there efforts to build capacity at different levels (e.g., education, civic participation)?

Multi-Scalar Interactions (C10)

- How does Baku's local energy transition interact with national or international sustainability agendas?
- Are there conflicts or synergies between local, national, and international actors?

## Data availability

The authors do not have permission to share data.

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