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Social Capital and Climate Change: Local Adaptation and Resilience Through Social Capital

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Abstract

Climate change presents an escalating global challenge, profoundly impacting ecosystems and human societies through extreme weather events, resource scarcity, and environmental degradation. Achieving sustainability necessitates a balanced integration of environmental preservation with societal well-being, fostering resilience in vulnerable communities. This paper explores the critical role of social capital—the networks, norms, and trust embedded in social structures—in facilitating local climate adaptation and building resilience. Utilizing a combined bibliometric analysis and structured literature review of academic publications, this study examines research trends, identifies key thematic clusters, and synthesizes empirical evidence on how social capital influences adaptive capacities. Unlike previous studies that separately examined social or environmental aspects, this research uniquely integrates bibliometric mapping with contextual literature synthesis to reveal emerging global patterns and knowledge gaps in the social dimensions of climate adaptation. The study further introduces a conceptual linkage between social capital typologies and local resilience mechanisms, offering a new interdisciplinary framework for understanding community-based adaptation. The findings highlight the growing academic interest in this interdisciplinary field, underscore the significance of social networks in local adaptive strategies, and reveal both the enabling mechanisms and persistent barriers to leveraging social capital for effective climate action. This research provides a comprehensive overview for researchers and policymakers seeking to enhance community-led adaptation initiatives. By combining quantitative trend analysis and qualitative synthesis, this research advances scholarly understanding and provides evidence-based recommendations for policymakers seeking to strengthen community-led adaptation initiatives.

Introduction

The escalating crisis of climate change represents one of the most profound challenges of the 21st century, manifesting in a myriad of devastating impacts on human lives and natural systems. From intensified extreme weather events like floods, droughts, and heatwaves, to gradual shifts such as sea-level rise and biodiversity loss, these environmental transformations disrupt livelihoods, displace populations, exacerbate health issues, and deepen existing social inequalities (Banu & Fazal, 2025). Vulnerable communities, particularly those in developing regions, often bear the disproportionate burden of these impacts, facing direct threats to their food security, water availability, and overall well-being (Khine & Langkulsen, 2023; Raj et al., 2022). Recognizing the pervasive and multifaceted nature of these challenges is crucial for fostering effective global and local responses.

In response to these pressing environmental concerns, the global discourse has increasingly emphasized the imperative of achieving sustainability. True sustainability extends beyond mere environmental protection; it demands a harmonious and balanced integration of human societies with the natural world, acknowledging the intricate interdependencies between people and planet (Hariram et al., 2023, 2024). This holistic approach necessitates developing strategies that not only mitigate environmental degradation but also enhance societal well-being, ensuring that current needs are met without compromising the ability of future generations to meet their own. Building resilient communities capable of absorbing, adapting to, and transforming in the face of environmental shocks is therefore a cornerstone of sustainable development.

Within the fabric of daily life, individuals and communities naturally form intricate webs of relationships that collectively constitute social capital. This multifaceted concept encompasses the norms of reciprocity, trust, and shared understanding that facilitate collective action and enhance cooperation among individuals and groups. Whether through informal neighborhood networks, formal community organizations, or shared cultural practices, social capital acts as an invisible yet powerful resource, enabling people to navigate challenges, share resources, and achieve common goals (Bukachi et al., 2021; Wang & Li, 2022). Its omnipresence in human interaction makes it a potentially vital, yet often overlooked, asset in addressing complex societal problems.

A burgeoning area of scholarly inquiry suggests a compelling link between this inherent social capital and the capacity for climate adaptation and resilience. Social capital can serve as a critical enabler, providing avenues for collective learning, facilitating the dissemination of vital information, mobilizing resources, and fostering collaborative decision-making processes necessary for effective local responses to climate change impacts (Bernados & Ocampo, 2024). From organizing community-level disaster preparedness to implementing sustainable agricultural practices, the inherent strength of social bonds can significantly bolster a community's ability to anticipate, cope with, and recover from climate-related

stresses (Zhai & Lee, 2024). Understanding this nexus is paramount for designing robust and context-specific adaptation strategies.

Guided by the overarching aim of exploring the interplay between social capital and climate resilience, this study seeks to answer the central research question: How does social capital—through its bonding, bridging, and linking dimensions—shape local communities' adaptive capacities and resilience in responding to climate change? To address this question, the study pursues three specific objectives. First, it aims to identify and map global research trends and thematic clusters related to social capital and climate adaptation through bibliometric analysis. Second, it seeks to synthesize empirical and conceptual findings from prior studies to explain the mechanisms by which social capital enhances adaptive capacity and community resilience. Third, it endeavors to develop an integrative framework linking different forms of social capital with local adaptation strategies, providing insights for both theoretical refinement and practical policymaking. These clearly defined objectives ensure analytical coherence and measurable contributions to the understanding of social capital's role in fostering local adaptation and resilience.

This study aims to comprehensively explore the interplay between social capital and climate adaptation or resilience. Specifically, it seeks to analyze the trends and evolution of keywords within academic literature on these topics, and to synthesize new, nuanced insights regarding the practical application and theoretical implications of leveraging social capital for climate action. To achieve these aims, the research employs a dual methodological approach, combining a systematic bibliometric analysis to map the intellectual landscape with a structured literature review to provide in-depth contextual understanding and interpretative synthesis of existing knowledge.

Methods

This study adopts a bibliometric approach to analyze academic literature related to social capital and climate adaptation. Bibliometric analysis offers an objective and systematic way to assess research trends, influential publications, collaboration networks, and thematic developments in a specific field (Donthu et al., 2021; Gunawan, 2025). By evaluating keyword co-occurrences, this method enables a comprehensive mapping of the intellectual landscape surrounding social capital and climate adaptation research. This quantitative approach provides a robust foundation for identifying the scope and evolution of the field, complementing the qualitative insights derived from the literature review. To ensure rigor and relevance, a set of clear criteria was established to identify studies directly related to social capital and climate adaptation research. As of June 2025, a comprehensive search was conducted in the Scopus database using the precise keywords "social capital*" AND "climate change*". Scopus was selected as the primary database due to its broad multidisciplinary coverage, extensive indexing of peer-reviewed literature, and detailed citation analysis capabilities, which are essential for capturing both

foundational works and recent developments in this interdisciplinary field (Singh et al., 2021). The search strategy aimed to be inclusive of various facets of "social capital" (e.g., social capital, social networks, trust) and "climate change" (e.g., climate change, climate adaptation, climate resilience). Data retrieved, including titles, abstracts, keywords, authors, affiliations, and citation information, were exported in a format compatible with bibliometric software. The exported data were then imported into VOSviewer software, which is widely used for bibliometric visualization and clustering of thematic networks. This software facilitates the creation of network maps based on co-occurrence data, allowing for a visual representation of the relationships between keywords, authors, or countries. Document selection followed strict inclusion criteria to ensure scholarly relevance and consistency; only peer-reviewed journal articles, conference proceedings, and book chapters were considered. No restriction was imposed on the year of publication, enabling a full-spectrum view of research evolution from the earliest contributions to the most recent. The initial search yielded 365 relevant documents, which were subsequently subjected to further refinement and analysis within VOSviewer. The thresholds for keyword co-occurrences were set such that only keywords appearing at least 3 times were included in the analysis. This process enabled the identification of key research clusters, dominant themes, and potential gaps in the literature for future exploration, providing a structured understanding of the research landscape.

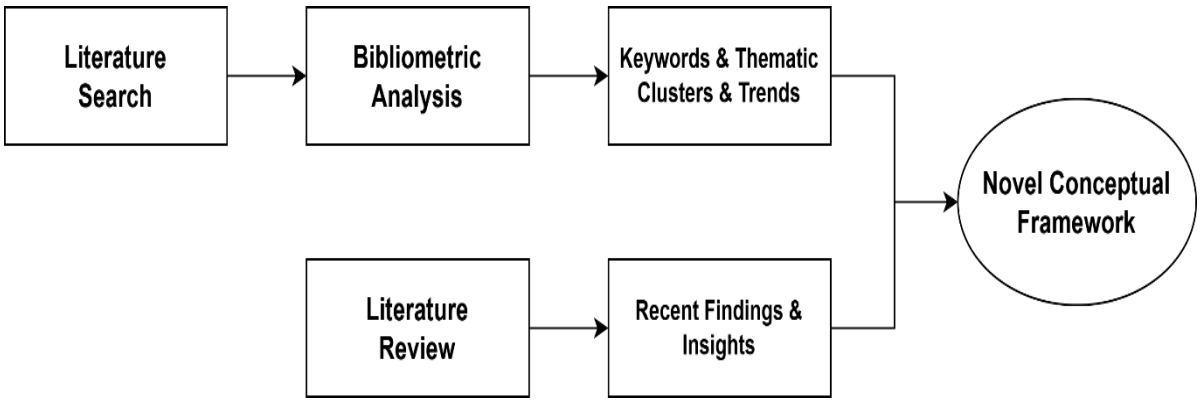


Fig. 1. Methodological Flow of the Study.

In addition to bibliometric mapping, this research conducted a structured literature review based on peer-reviewed publications that discuss the principles, implementation, and challenges in achieving local climate adaptation and resilience through social capital (Figure 1). The literature review serves to complement the bibliometric findings by providing contextual depth and interpretive synthesis, elucidating the "how" and "why" behind the identified trends. Articles were selected primarily from Google Scholar and Scopus databases, utilizing the same search terms ("social capital*" AND "climate change*") to maintain consistency with the bibliometric analysis. This dual approach ensures both a broad overview of the field and a detailed qualitative understanding of its core themes. Eligible articles for the literature review had to be accessible in either English or Bahasa Indonesia, reflecting the global and regional relevance of the topic, and presented in the form of peer-reviewed journal articles, book chapters, or conference proceedings. This criterion ensured the academic rigor and reliability of the sources. The review focused on presenting a narrative point of view by identifying empirical evidence and conceptual frameworks that reveal how social capital mechanisms influence climate adaptation and resilience. This involved a systematic reading and synthesis of the selected literature to extract key arguments, findings, and theoretical underpinnings. This integrative review also categorized the literature into theoretical, empirical, and policy-oriented contributions. Theoretical contributions provided conceptual models and frameworks explaining the relationship between social capital and climate action. Empirical studies offered case-specific evidence and quantitative or qualitative data on the impacts of social capital. Policy-oriented contributions discussed recommendations, interventions, and implications for governance. The ultimate aim of the literature review was to synthesize current knowledge, identify existing gaps in understanding, and generate informed recommendations for enhancing climate adaptation and resilience through the strategic harnessing of social capital at the local level.

Result

The findings of this study are presented in two main sections: the bibliometric analysis, which provides a quantitative overview of the research landscape, and the literature review, which offers a qualitative synthesis of key concepts, mechanisms, and challenges.

1.1. Bibliometric Analysis

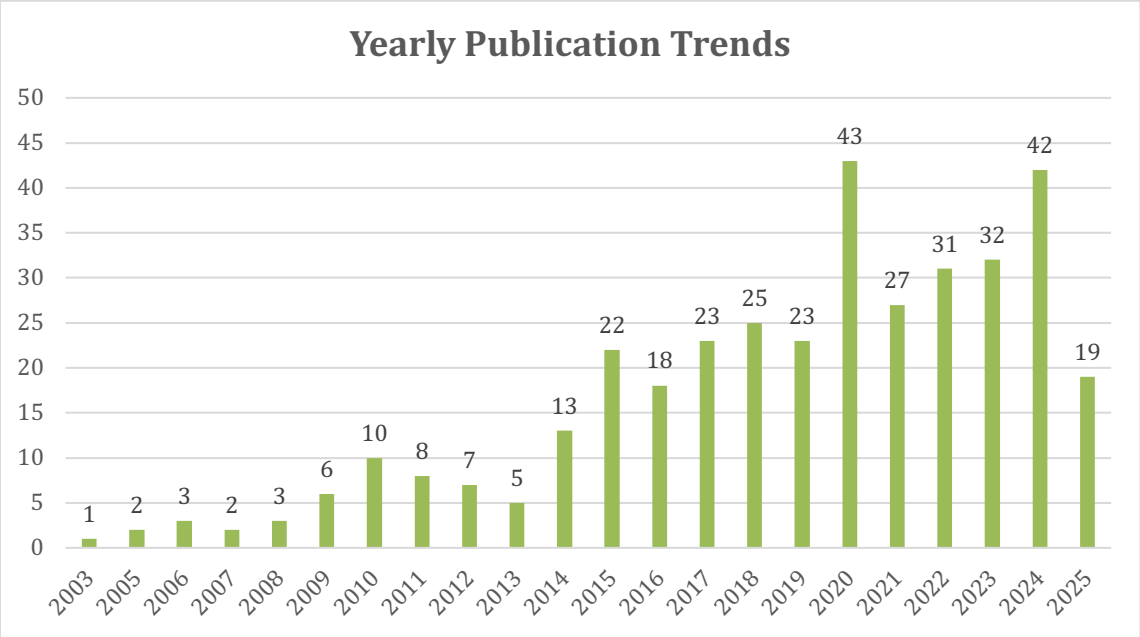


Fig. 2. Yearly Publication Trends.

Figure 2 illustrates the yearly publication trends on the intersection of social capital and climate change from 2003 to 2025. The graph reveals a significant upward trajectory in publications over this period, indicating a growing academic interest in the topic. From 2003 to around 2008, the number of publications remained very low, typically below 5 documents per year, suggesting that this was an emerging or nascent area of research. A noticeable increase began around 2009-2010, with publications reaching 6 and 10, respectively, followed by a slight dip in 2012.

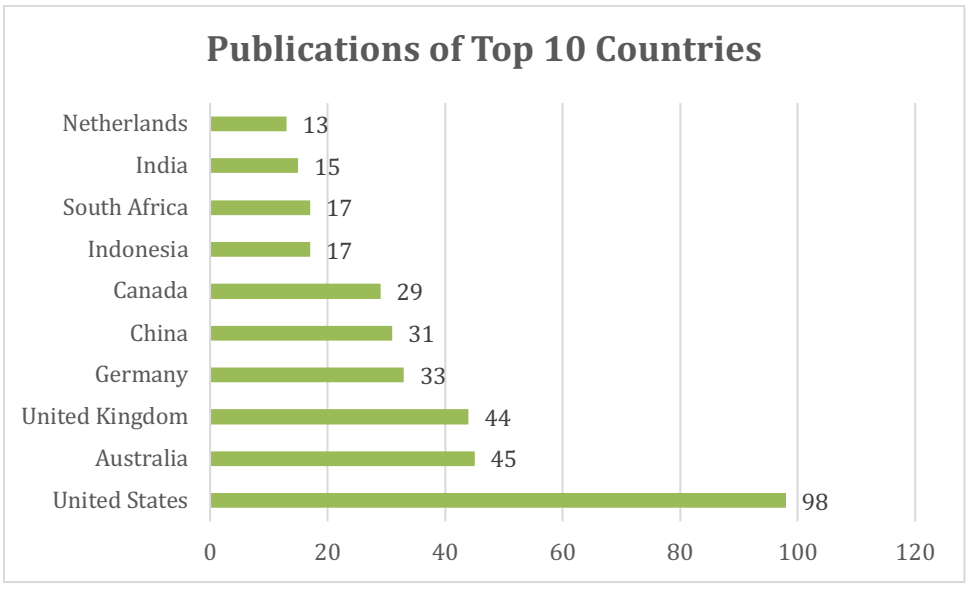


Fig. 3. Publications of (A) Top 10 Countries, (B) Global Countries.

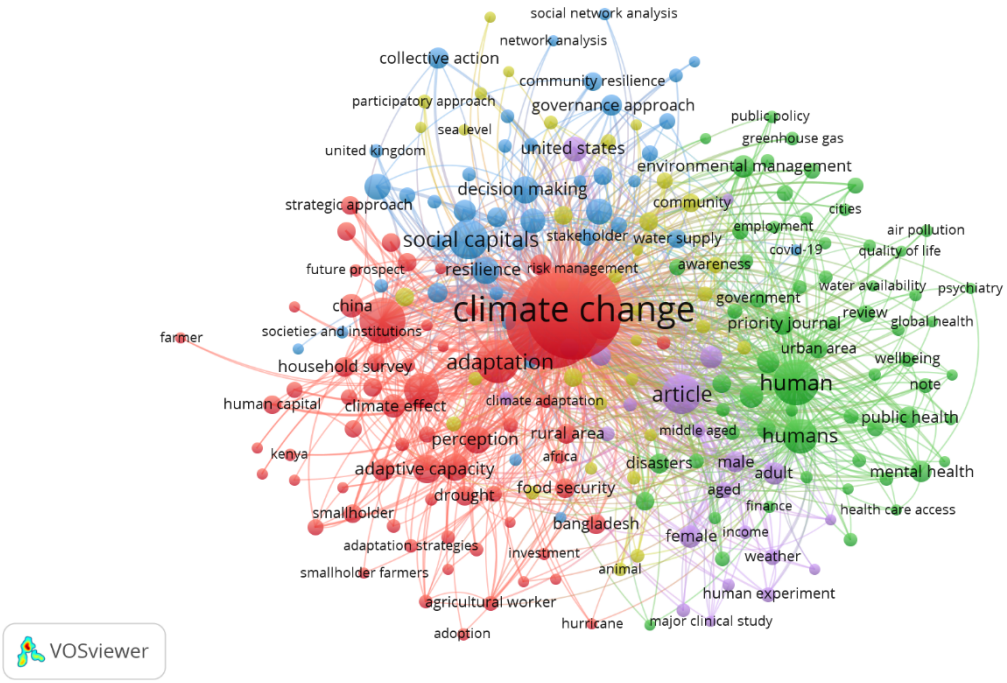
The trend clearly shows sustained growth from 2013 onwards, moving from 13 publications to a peak of 43 publications in 2020. This peak likely reflects a confluence of factors: increased global awareness of climate change urgency, the growing recognition of social dimensions in environmental governance, and perhaps a maturation of interdisciplinary research methodologies that bridge social sciences and environmental studies. After 2020, there's a slight fluctuation, with a dip to 27 in 2021, followed by a rise to 31 in 2022 and another increase to 42 in 2024. The data for 2025, with 19 publications, suggests that the year is not yet complete or there's a slight decrease, but overall, the general trend indicates a robust and continuous interest in the field. The consistent growth over nearly two decades underscores the enduring relevance and increasing importance attributed to understanding the social dimensions of climate change adaptation.

Figure 3A and 3B highlight the geographic distribution of research contributions, specifically showcasing the top 10 countries with major contributions to the topics of social capital and climate change, and their global perspective. The United States stands out as the leading contributor by a significant margin, with 98 publications, almost double that of the next highest country. Australia follows with 45 publications, and the United Kingdom with 44 publications. These three countries, predominantly from the Global North, exhibit a strong research focus in this interdisciplinary area.

Among the top 10, European countries are well-represented, including the United Kingdom (44), Germany (33), and the Netherlands (13). This indicates a substantial European involvement in research on social capital and climate change.

Asia is represented by China (31) and India (15), demonstrating a growing research presence from this continent, particularly from rapidly developing economies that are highly vulnerable to climate impacts. Africa is represented by South Africa (17), and North America by Canada (29), besides the US. Indonesia (17 publications) also appears in the top 10, showing emerging contributions from Southeast Asia.

From a global perspective (Figure 3B), the distribution of publications is largely concentrated in North America (especially the US and Canada), Europe, Australia, and parts of East and South Asia. There are noticeable gaps in research output from large parts of South America, Africa (beyond South Africa), and Central Asia, suggesting potential areas for future research focus and collaboration. The dominance of developed nations in this research area might reflect greater funding opportunities, established research infrastructure, and a longer history of interdisciplinary academic pursuits. However, the presence of countries like China, India, Indonesia, and South Africa in the top contributors signifies an increasing recognition of the relevance of social capital in climate action within the Global South, particularly in regions facing acute climate challenges.



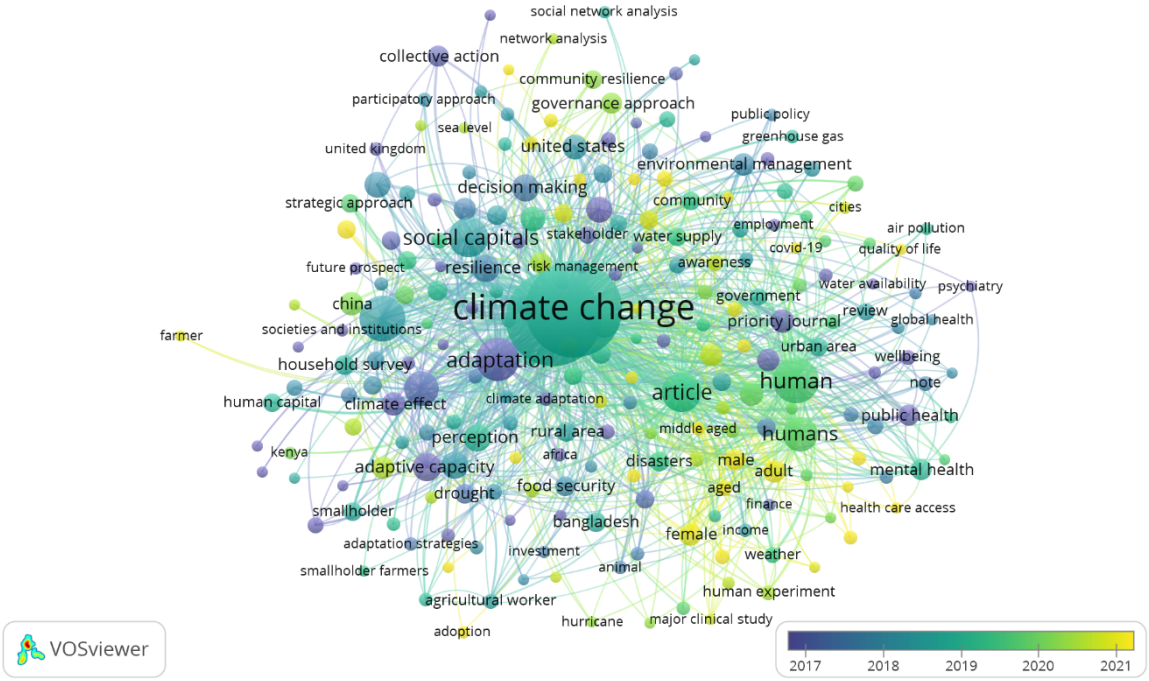


Fig. 4. Keyword Trends (A) Network Visualization, (B) Overlay Visualization.

Figure 4A (Network Visualization) displays the most prominent keywords and their interconnections in studies regarding social capital and climate change. The size of each node reflects the frequency of the keyword's appearance, while the links indicate co-occurrences. "Climate change" and "social capital" are centrally located and are the largest nodes, indicating their foundational role in the literature. Around these core terms, several distinct clusters emerge, each representing a specific thematic area.

There are primarily three prominent clusters visible:

a. Red Cluster (Adaptation and Vulnerability)

This cluster heavily revolves around "adaptation," "adaptive capacity," "vulnerability," "drought," "food security," and terms related to specific geographic contexts like "Africa," "Kenya," and "Bangladesh." It also includes "smallholder farmers" and "human capital," suggesting a strong focus on the practical dimensions of climate adaptation, particularly in agricultural and developing contexts. This cluster explores how communities, especially those reliant on natural resources, utilize social capital to cope with climate impacts and enhance their adaptive strategies. Keywords like "perception" and "climate effect" indicate a focus on local understanding and experienced impacts.

b. Green Cluster (Human Dimensions and Health)

This cluster is centered around "human" and "humans," encompassing "public health," "wellbeing," "mental health," "health care access," and "gender" (female income, male, adult, aged). It also includes "governance," "community," and "environmental management." This suggests a strong emphasis on the

societal and health-related consequences of climate change, and how social capital might mediate these impacts. Terms like "cities" and "urban area" indicate a focus beyond just rural adaptation, exploring social capital's role in urban resilience. "Covid-19" also appears, hinting at the intersection of climate change with other global crises and the role of social networks during multiple stresses.

c. Blue and Purple Cluster (Governance, Networks, and Resilience)

This cluster includes keywords such as "community resilience," "governance approach," "collective action," "decision making," "network analysis," and "stakeholder." It also features "United States" and "United Kingdom," suggesting a focus on developed country contexts and the more institutional or structural aspects of social capital in climate governance. This cluster explores how social networks and collective action mechanisms, often facilitated by robust governance frameworks, contribute to overall community resilience against climate impacts. Terms like "strategic approach" and "risk management" imply a focus on calculated, planned, and proactive strategies.

Figure 4B (Overlay Visualization) reveals the temporal evolution of these keyword trends from 2017 to 2021, indicated by color coding (blue for earlier years, yellow for later years). This figure shows a clear shift in research focus over time. Earlier research (represented by darker blue nodes, typically before 2018) appears to have a stronger emphasis on foundational concepts such as "climate change," "social capital," and general "adaptation" and "resilience" ideas. As time progresses towards 2021 (represented by lighter yellow/green nodes), there is a noticeable emergence and strengthening of more specific and applied keywords. For instance, terms within the green cluster, such as "human," "wellbeing," "public health," "mental health," and specific age groups like "aged" and "adult," become more prominent in later years. This suggests a growing recognition of the direct human and health dimensions of climate change, and the role of social capital in addressing these. Similarly, within the red cluster, more nuanced terms related to "food security," "drought," and specific geographic contexts (e.g., "Bangladesh") appear more frequently in recent years, indicating a shift towards more localized and impact-specific studies. The blue/purple cluster also shows more recent interest in "network analysis" and "community resilience," suggesting an evolving focus on methodological sophistication and systemic approaches to resilience building. Overall, the trend indicates a move from broad conceptual explorations to more detailed, applied, and human-centric investigations within the field.

1.2. Literature Review on Social Capital and Climate Adaptation

1.2.1. Social Capital Concepts

Social capital, a concept originating from various social science disciplines, refers to the collective value of all social networks (who people know) and the inclinations that arise from these networks to do things for each other (norms of

reciprocity) (Grix, 2001). While various definitions exist, a widely accepted understanding posits social capital as the features of social organization, such as networks, norms, and trust, that facilitate coordination and cooperation for mutual benefit. It is not an individual attribute but rather a property of relationships and social structures, acting as a resource embedded within these connections (Rostila, 2011). This relational aspect is key to understanding its potential impact on collective action and community outcomes, particularly in the face of shared challenges like climate change.

Scholars like Pierre Bourdieu emphasized social capital as a resource derived from group membership, convertible into economic or cultural capital (Julien, 2015). He highlighted its role in enabling individuals to leverage collective resources for personal gain. In contrast, James Coleman viewed social capital as a public good, focusing on its functional role in creating human capital and facilitating collective action within families and communities (Hayami, 2009). Coleman's perspective underscored how trust and obligations within networks can reduce transaction costs and foster cooperation, making it easier for groups to achieve common goals that might otherwise be difficult for individuals alone. This "facilitative" aspect is highly relevant in contexts requiring collective responses to environmental threats.

Robert Putnam further popularized the concept, distinguishing between different forms of social capital (Claridge, 2018; Gelderblom, 2018). He identified bonding social capital as strong ties among homogeneous groups (e.g., family, close friends), which are crucial for "getting by" and providing internal support and solidarity. Bridging social capital, on the other hand, refers to weaker ties between heterogeneous groups (e.g., different social classes, communities), which are essential for "getting ahead" by connecting individuals to external resources, information, and opportunities. A third type, linking social capital, describes connections between individuals or groups across hierarchical power structures (e.g., with government officials or external aid organizations), enabling access to resources and influence from higher authorities. These distinctions are critical for understanding how different types of social networks contribute to varied aspects of climate adaptation and resilience.

The operationalization of social capital in research often involves measuring aspects such as trust (generalized and particularized), networks (density, diversity, size), and norms (reciprocity, civic engagement) (Engbers et al., 2017). Trust, for instance, reduces uncertainty and facilitates transactions, making individuals more willing to collaborate on shared projects, including climate initiatives. Networks provide channels for information flow, resource mobilization, and collective decision-making. Norms, such as those of civic participation and mutual assistance, shape collective behavior and reinforce cooperative actions. These measurable dimensions allow researchers to assess the presence and impact of social capital in

various contexts, from local communities to broader societal levels. Despite its widespread application, the concept of social capital is not without its critics. Some argue that it can also have negative externalities, leading to exclusion (e.g., bonding capital creating "us vs. them" mentalities), reinforcing inequalities, or being exploited for illicit activities (Baycan & Öner, 2023). For example, strong bonding ties within a group might lead to resistance against external ideas or technologies necessary for adaptation. Therefore, a nuanced understanding of social capital requires acknowledging both its positive and potentially negative manifestations, particularly when considering its role in complex social-ecological systems facing climate change.

In the context of environmental governance and climate action, social capital is increasingly viewed as a crucial community asset that underpins collective action. It fosters the collaborative spirit necessary for shared resource management, community-based adaptation planning, and the implementation of resilience-building initiatives. By enabling communities to organize, communicate, and act collectively, social capital can bridge gaps between individual actions and systemic change, transforming individual adaptive capacities into robust community-level resilience (Pooyan & Hokugo, 2025). This makes it a valuable, albeit complex, resource for enhancing local responses to climate vulnerabilities.

1.2.2. How Social Capital Influences Climate Adaptation and Resilience

Social capital acts through several key mechanisms to significantly influence a community's capacity for climate adaptation and resilience. Firstly, it enhances information exchange and dissemination. Strong social networks, particularly those characterized by bridging and linking social capital, facilitate the rapid and efficient flow of critical information related to climate risks, early warning signals for extreme weather events, and best practices for adaptation (Guardaro et al., 2022; Shah et al., 2024). For instance, trusted local leaders or community groups can effectively communicate climate science and adaptive strategies, translating complex information into actionable knowledge for local residents, which is vital for timely and appropriate responses during a crisis or for long-term planning.

Social capital also plays a crucial role in mobilizing resources. Through established networks, communities can pool various forms of resources—financial, material, and human—that are essential for implementing adaptation measures (Behera, 2023; Roque et al., 2021). Bonding social capital enables neighbors to share labor and equipment for recovery efforts post-disaster, while bridging social capital connects communities with external organizations, non-governmental organizations (NGOs), or government agencies that can provide funding, technical expertise, or relief supplies (Partelow, 2021; Tan-Mullins et al., 2021). This collective resource mobilization capacity is particularly critical in resource-scarce environments where individual households may lack the means to adapt independently.

On the other hand, social capital fosters collective action and collaborative decision-making. The presence of trust and shared norms reduces the costs of collective action, making it easier for community members to cooperate on shared adaptation initiatives (Guttmann, 2021; Wannewitz & Garschagen, 2023). These capitals can manifest in community-led initiatives such as building flood defenses, developing communal water storage systems, or establishing local seed banks to enhance food security. Bridging and linking social capital are particularly important here, as they enable diverse stakeholders—from local residents and traditional authorities to policymakers and scientific experts—to come together, share perspectives, and formulate effective and equitable adaptation plans that address shared vulnerabilities (Opoku-Boateng et al., 2024; Vasseur et al., 2022).

Furthermore, social capital contributes to psychological and emotional support, which is often overlooked but critical for resilience. In times of climate-induced stress, such as displacement or livelihood disruption, strong social ties provide emotional comfort, mental health support, and a sense of belonging. These social safety nets help individuals and communities cope with trauma, reduce anxiety, and maintain a positive outlook, thereby preventing psychological distress from undermining adaptive capacities (Ntontis et al., 2020; Tang & Ho, 2025). This supportive environment enables communities to recover more effectively and prevents long-term negative impacts on well-being (Fritze et al., 2008). Social capital can strengthen institutional legitimacy and governance. When local institutions (formal or informal) are embedded within strong social networks and operate with high levels of community trust, they are more likely to be perceived as legitimate and effective. This legitimacy encourages greater community participation in governance processes related to climate adaptation, ensuring that policies and interventions are context-specific, equitable, and widely adopted. Linking social capital, in particular, facilitates productive engagement between local communities and higher-level government bodies, leading to more responsive and effective climate policies (Moghfeli et al., 2023).

In terms of adaptation, social capital aids in learning and innovation. Networks provide platforms for sharing experiential knowledge, traditional ecological knowledge, and innovative adaptive solutions among community members. Through observation, peer-to-peer learning, and collective experimentation, communities can refine existing practices or develop new strategies to cope with changing climatic conditions. This adaptive learning process, facilitated by open communication and trust within social networks, allows for continuous improvement in climate responses and fosters local innovation in the face of evolving environmental challenges. It also facilitates social cohesion and conflict resolution. Climate change impacts can exacerbate existing social inequalities and lead to resource-based conflicts. High levels of social capital, characterized by shared norms

and strong relational ties, can help mediate potential conflicts and foster social cohesion within diverse communities (Medina et al., 2024; Visave & Aldrich, 2025). This cohesion ensures that adaptation efforts do not disproportionately burden certain groups and that benefits are shared equitably, leading to more inclusive and sustainable adaptation outcomes. It allows communities to navigate trade-offs and disagreements more constructively.

Finally, social capital enhances community preparedness and early warning systems. Well-connected communities can develop robust informal and formal early warning systems, disseminating information quickly and mobilizing collective action during emergencies (Shah et al., 2024). For example, local social networks can quickly spread warnings about impending storms or floods, ensuring that vulnerable individuals receive timely assistance. This proactive preparedness, driven by strong social ties, significantly reduces the human and economic costs of climate disasters and enhances overall community resilience.

1.2.3. Barriers and Challenges in Achieving Climate Adaptation and Resilience via Social Capital

Despite the profound potential of social capital in fostering climate adaptation and resilience, its effective harnessing is not without significant barriers and challenges. Firstly, exclusivity and homogeneity can limit the reach and benefits of social capital. Bonding social capital, while providing strong internal support, can also create "us vs. them" dynamics, leading to the exclusion of marginalized groups (e.g., migrants, ethnic minorities) from adaptation initiatives or resource allocation (Lo & Fan, 2020). This can exacerbate existing inequalities and undermine collective resilience by failing to address the needs of the most vulnerable, potentially leading to social fragmentation rather than unified action. Secondly, power imbalances and elite capture can severely impede the equitable distribution of benefits from social capital. In communities with entrenched hierarchies, existing social networks might be dominated by powerful individuals or groups who can divert resources and decision-making processes to their own advantage, marginalizing the voices and needs of less powerful community members (Brear, 2020; Noori, 2022). This "dark side" of social capital means that even seemingly strong networks may not translate into effective or equitable adaptation outcomes for the entire community, leading to resentment and reduced overall resilience.

Furthermore, weak bridging and linking social capital often restricts access to external resources and information. Many vulnerable communities possess strong bonding social capital but lack robust connections to external institutions, government agencies, or scientific bodies. This disconnect limits their ability to access crucial funding, technical expertise, policy support, and broader climate information, all of which are vital for implementing large-scale or technologically advanced

adaptation measures (Dressel et al., 2020; Fraser & Naquin, 2022). Without these external linkages, local adaptation efforts can remain isolated, under-resourced, and less effective in the long run. Rapid social change and urbanization can also erode traditional forms of social capital. Modernization, migration, and the shift from rural to urban lifestyles can weaken traditional community bonds, informal support networks, and shared norms of reciprocity. In rapidly growing urban centers, individuals may experience greater anonymity and less social cohesion, making it harder to foster the trust and collective action necessary for urban climate adaptation planning (Colding et al., 2021).

On the other hand, a lack of institutional support and recognition poses a significant challenge. Even where strong social capital exists, it may not be effectively leveraged if formal institutions (government, NGOs) do not recognize its value, provide mechanisms for its integration into planning, or offer appropriate support. Bureaucratic hurdles, rigid top-down approaches, and a failure to engage local social structures can undermine community-led initiatives, leading to missed opportunities to build on existing social strengths for adaptation (M. F. Rahman et al., 2023). Moreover, conflicting interests and fragmented governance can undermine the potential of social capital. Different community groups or external stakeholders may have divergent interests regarding climate adaptation strategies, leading to conflicts that social capital alone cannot resolve (Nadiruzzaman et al., 2022). Furthermore, fragmented governance structures, where responsibilities for climate action are dispersed across multiple agencies without clear coordination, can make it difficult for social capital to translate into coherent and effective collective action at a broader scale (Nässén et al., 2024; Radinger-Peer et al., 2025).

Insufficient financial resources often hinder the practical application of social capital. While social capital can mobilize non-monetary resources, many adaptation measures require significant financial investment (e.g., building resilient infrastructure, relocating communities) (Ahumada et al., 2024). Even with strong social cohesion, communities may lack the necessary funds to implement comprehensive adaptation plans, highlighting the need for external financial support to complement social capital-driven initiatives. Finally, lack of trust in formal institutions can be a significant barrier. If communities have a history of negative experiences with government or external organizations (e.g., broken promises, corruption), their linking social capital will be low (Lo & Fan, 2020; Peeters & Dussauge Laguna, 2021). This lack of trust can lead to resistance towards externally driven adaptation projects, reduced participation in official planning processes, and a general reluctance to share information or resources with formal bodies, thereby limiting the potential for synergistic adaptation efforts between communities and broader governance structures.

Discussion

This study, through a combined bibliometric analysis and literature review, sought to explore the intricate relationship between social capital and climate adaptation and resilience. The main findings reveal a burgeoning academic interest in this interdisciplinary field, evidenced by the consistent growth in publications since the early 2000s, peaking significantly in recent years. This trend underscores a global recognition of the crucial, yet often underestimated, social dimensions of climate change responses. Geographically, research contributions are dominated by developed nations, particularly the United States, Australia, and the United Kingdom, indicating a well-established research infrastructure and funding landscape in these regions. However, the notable presence of countries from the Global South (e.g., China, India, Indonesia, South Africa) signals an increasing acknowledgment of the practical urgency and local relevance of this nexus in climate-vulnerable contexts.

The bibliometric analysis of keyword trends further elucidated the evolving focus of research. Early studies centered on foundational concepts like "climate change" and "social capital" (Carmen et al., 2022; Paul et al., 2016; Petzold & Ratter, 2015) while more recent research has shifted towards granular, human-centric, and context-specific themes such as "human wellbeing", "public health", "food security", and localized impacts like "drought" (Bikomeye et al., 2021; Nosratabadi et al., 2020; M. A. Rahman et al., 2024; Tamasiga et al., 2024). This evolution reflects a maturation of the field, moving from broad conceptualization to nuanced empirical investigation and a deeper understanding of the socio-economic and health implications of climate change. The thematic clusters identified—adaptation and vulnerability; human dimensions and health; governance, networks, and resilience—demonstrate the multi-faceted nature of social capital's role in addressing climate challenges (Al Maamari, 2024; Mallick et al., 2024; Stotten, 2023).

Connecting these research findings to real-world practices, it becomes evident that social capital is not merely an academic construct but a tangible asset in community-led climate action. In practice, strong bonding social capital facilitates immediate, localized responses, such as community-based disaster relief, shared agricultural knowledge, and peer-to-peer support networks during extreme weather events (Idziorek, 2025). For instance, in many rural communities, traditional practices of collective labor (e.g., "gotong royong" in Indonesia or "ubuntu" in Southern Africa) exemplify how social cohesion mobilizes resources for infrastructure maintenance or recovery after climate shocks. Bridging social capital, meanwhile, is crucial for communities to engage with external actors, access funding, and integrate into broader adaptation plans, as seen in collaborative projects between non-governmental organizations, local governments, and community groups (Azad & Pritchard, 2023; Masud-All-Kamal et al., 2021).

Beyond describing current patterns, this study contributes theoretically by bridging a key gap in the literature concerning the integration of social capital theory with climate adaptation research. Previous studies (Choo and Yoon, 2022; Hall et al., 2023) have often treated social capital either as a general community resource or as a contextual variable influencing disaster responses, without systematically linking its multidimensional forms—bonding, bridging, and linking—to specific mechanisms of adaptation and resilience. This study advances the discourse by explicitly connecting these dimensions with functional pathways identified in both bibliometric and qualitative analyses, namely information exchange and learning, psychosocial support, and collective action and governance legitimacy. This analytical alignment reveals how different types of social capital operate across scales, from individual and household levels to institutional and transnational networks, to reinforce community resilience. Moreover, by combining bibliometric mapping with interpretative synthesis, this research introduces a hybrid approach that demonstrates how evolving scholarly networks mirror the practical evolution of social capital in climate adaptation initiatives (Figure 5). In doing so, it not only maps the intellectual landscape but also extends social capital theory by situating it within dynamic socio-ecological systems where trust, reciprocity, and collaboration become adaptive assets. This theoretical expansion emphasizes that social capital is not a static construct but a continuously evolving relational capacity that co-develops with environmental challenges, thus offering a deeper understanding of its role in sustainable climate governance.

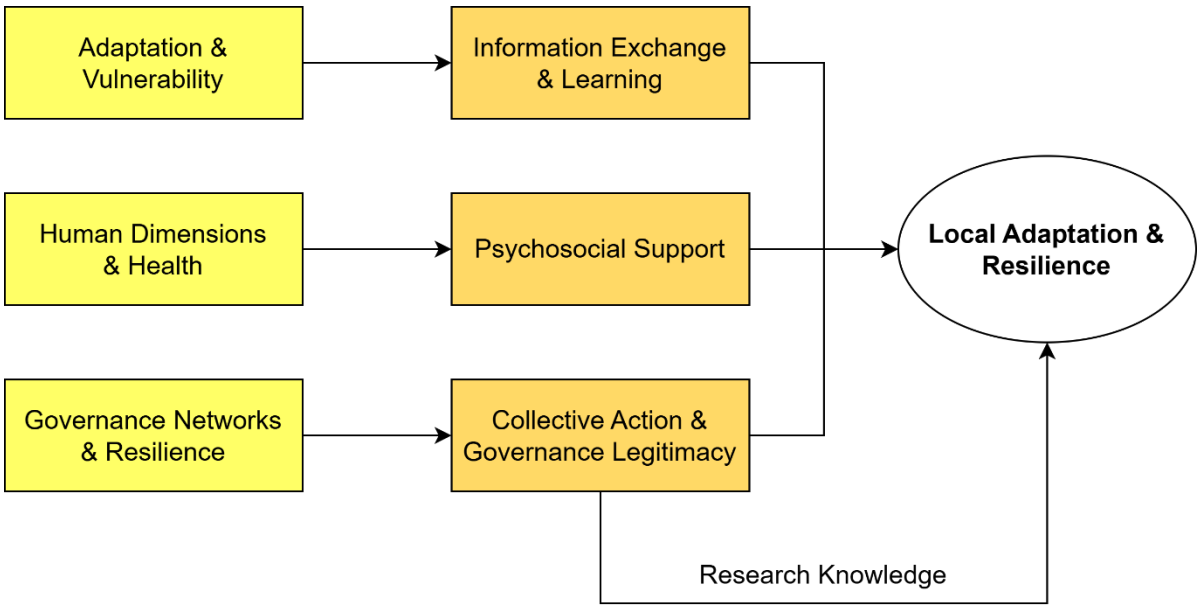


Fig. 5. Conceptual Framework Linking Bibliometric Clusters with Social Capital Mechanisms for Climate Adaptation and Resilience

The conceptual framework presented in Figure 5 illustrates how the quantitative findings from the bibliometric analysis intersect with the qualitative insights from the literature review to reveal the multidimensional pathways through which social capital contributes to climate adaptation and resilience. The framework integrates three principal bibliometric clusters—Adaptation and Vulnerability, Human Dimensions and Health, and Governance, Networks, and Resilience—each corresponding to distinct functional mechanisms of social capital. The first cluster, Adaptation and Vulnerability, aligns with information exchange and learning, emphasizing how trust-based networks facilitate the dissemination of adaptive knowledge, early warning information, and shared local practices. The second cluster, Human Dimensions and Health, corresponds to psychosocial support, highlighting the emotional, mental, and communal well-being fostered by strong social ties during climate-related stress. The third cluster, Governance, Networks, and Resilience, links to collective action and governance legitimacy, reflecting how bridging and linking social capital strengthen institutional collaboration, participatory decision-making, and public trust in climate governance. Together, these interconnected mechanisms converge toward the central goal of local adaptation and resilience, forming a cyclical system in which research knowledge and community experience continuously inform one another. This integrated framework thus connects the evolving global research landscape with on-the-ground adaptive processes, providing a holistic understanding of how social capital functions as both a theoretical construct and a practical driver of climate resilience.

The implications of these findings are profound for both policy and practice. Firstly, there is a clear implication for policy integration: policymakers must move beyond purely technical or infrastructure-based solutions and explicitly recognize and integrate social capital into climate adaptation strategies. This requires understanding local social structures, empowering community-based organizations, and creating platforms for participatory decision-making that leverage existing networks of trust and reciprocity. Secondly, there is an imperative for capacity building and empowerment: efforts should focus on strengthening different forms of social capital, especially bridging and linking ties, in vulnerable communities. This could involve facilitating community-to-community learning exchanges, fostering multi-stakeholder dialogues, and training local leaders in community organizing and resource mobilization.

Furthermore, given the identified barriers, particularly issues of exclusivity and power imbalances, implications arise for inclusive governance. Adaptation policies must be designed to ensure that the benefits of social capital are equitably distributed and that marginalized groups are not excluded. This necessitates deliberate efforts to identify and engage vulnerable populations, implement transparent decision-making processes, and establish accountability mechanisms to prevent elite capture. Finally, the growing focus on human dimensions implies the need for holistic approaches to resilience. Climate adaptation efforts should not only address physical infrastructure but also prioritize mental health support, livelihood diversification, and strengthening social safety nets, recognizing social capital's vital role in enabling psychological and emotional resilience in the face of climate stressors.

Conclusion

This study has comprehensively examined the multifaceted relationship between social capital and local climate adaptation and resilience through a bibliometric analysis and structured literature review. The findings reveal a robust and growing academic discourse, reflecting increased global recognition of social capital as a critical asset in addressing climate change. Research trends show a clear evolution from broad conceptualizations to more specific, human-centric, and context-sensitive investigations, particularly concerning health, livelihoods, and localized vulnerabilities. This underscores the increasing emphasis on understanding how social networks, trust, and norms translate into tangible adaptive capacities at the community level.

The implications of this research are significant for both theory and practice. By recognizing and actively fostering social capital, policymakers and practitioners can move towards more effective, equitable, and sustainable climate adaptation strategies. This necessitates integrating social dimensions into policy frameworks, investing in capacity building to strengthen community networks, ensuring inclusive governance to prevent marginalization, and adopting holistic approaches that address both physical and psychosocial aspects of resilience. Ultimately, harnessing the inherent strength of social capital offers a powerful pathway to building more resilient communities capable of navigating the complex challenges posed by a changing climate.

Declarations

No ethical issues have arisen during the study, and all procedures followed comply with the ethical standards.

Author's contribution statement

William Ben Gunawan (WBG) conceptualized, collected data, and wrote the paper.

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Declaration of interests statement

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper. Alternatively, the authors declare the following financial interests/personal relationships, which may be considered as potential competing interests.

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