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# Reimagining Community Engagement: A Social Network Driven Approach to Flood Resilience

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## **Abstract**

Community Engagement (CE) is crucial for building flood resilience and empowering communities to participate actively in disaster preparedness, response, and recovery. However, many existing CE approaches neglect key social dimensions, such as inclusivity, social vulnerabilities, and community-driven strategies. This oversight often limits community ownership and reduces effectiveness. This research critically examines the social drivers of community engagement in flood resilience, emphasising the need for a Social Network approach to strengthen social connections, enhance participation, and foster sustained resilience. A review and synthesis of existing literature, spanning disaster risk management, flood resilience, social networks, behavioural science, and community engagement, identifies key internal and external drivers. The main internal drivers include social cohesion, leadership, education and local knowledge. Key external drivers include government support, partnerships, and technological resources. The findings highlight the importance of integrating internal and external drivers through Social Network Analysis (SNA) to foster cohesion, adaptability, and sustainability in community engagement. The research provides valuable theoretical insights for policymakers, practitioners, and researchers to improve collaboration, resource allocation, and community-led engagement. It advances knowledge by analysing key social drivers and introducing SNA as a framework to integrate these drivers for more effective community engagement. Future research will develop a theoretical framework and test the applicability of SNA in various contexts.

## Keywords

community participation, flood resilience, social network analysis

## 1 Introduction

Flooding is the most frequent type of natural disaster globally. Between 1998 and 2017, floods affected over 2 billion people, caused at least 157,000 deaths and left 1.81 billion people living in flood-prone areas (WHO 2023). Flood events displace millions of people, disrupt ecosystems, and lead to psychological impacts including anxiety and Post-Traumatic Stress Disorder (PTSD) (Xu *et al.* 2023). Urban populations are projected to reach 70% of the global total by 2050. Climate impacts are expected to disproportionately affect urban communities, particularly those that are economically and socially marginalised (IPCC 2023).

In the UK, at least one in six people in England are at risk of flooding from rivers and the sea (Environment Agency 2022a), with 5.7 million properties facing flood risks (House of Commons Library 2024). These risks are expected to escalate due to climate change, exacerbating fluvial, pluvial, and coastal flooding. Major flood events in the UK, such as the 1953 North Sea Flood and the 2007 Hull floods, highlighted the limits of traditional defences and the critical need for stronger community involvement in flood risk management (Pitt 2008). The Pitt Review emphasised local authority involvement and community engagement, leading to legislative reforms like the Flood and Water Management Act (2010). Recent investments, including the doubling of capital funding for flood projects to £5.2 billion from 2021 to 2027, reflect a growing commitment to resilience (House of Commons Library 2024). This funding supports initiatives such as the £200 million Flood and Coastal Resilience Innovation Programme (FCRIP), which aims to build community capacity to respond to and recover from flooding while adapting to future climate change. These efforts aim to reduce national flood risk by up to 11% by 2027 while fostering local ownership of resilience strategies (House of Commons Library 2024).

Historically, flood management has prioritised technical solutions like levees and barriers, which offer immediate protection. However, these approaches often sideline community engagement, social vulnerabilities, and inclusivity (Houston *et al.* 2021). The lack of integration of local knowledge reduces adaptability (Nsobya *et al.* 2024), weakens community participation, and reinforces perceptions of exclusion (Muzamil *et al.* 2022; Vanderhorst *et al.* 2024). This disengagement is particularly evident in preparedness, adaptation, and mitigation efforts, where limited community engagement and participation remain a significant issue (Vanderhorst *et al.* 2024). Communities are frequently treated as passive recipients of top-down solutions, limiting their decision-making power and ownership (Van Krieken and Pathirage 2019). Technocratic approaches prioritising structural interventions over community-driven initiatives further marginalise local voices (Driessen *et al.* 2018; Tariq *et al.* 2021). Poor communication of flood risks exacerbates these issues, emphasising the need for tailored and inclusive strategies that actively involve communities at all stages (Bayili 2024). Addressing these limitations requires community-centred approaches that integrate local knowledge, psychological support, and social networks to build trust, enhance inclusivity, and foster sustained engagement (Nsobya *et al.* 2024; Van Krieken and Pathirage 2019).

This study uses a literature review to analyse community engagement frameworks and identify key social drivers for engagement. It explores SNA as a tool to integrate internal and external social drivers, facilitating participatory and adaptive community-led approaches to flood resilience. By integrating insights from disaster risk management, flood resilience, social networks, behavioural science, and

community engagement, this research aims to critically explore the key social drivers of community engagement in flood resilience. It seeks to articulate the case for adopting a Social Network approach to strengthen social connections, enhance collective participation, and build sustained community resilience. The expected outcome is to showcase how SNA can strengthen community engagement strategies. It aims to align these strategies with global objectives such as SDG 11 (Sustainable Cities and Communities), SDG 13 (Climate Action), and the Sendai Framework for Disaster Risk Reduction (UNDRR 2015), while providing actionable insights for further research and practical implementation. The discussion begins with an analysis of existing frameworks and a review of the social drivers influencing community engagement. It then explores the role of SNA, highlights key findings, and concludes with actionable recommendations for future research.

## 2 Analysis of Existing Community Engagement Frameworks

This study employs a comprehensive literature review methodology to evaluate existing community engagement frameworks, drawing from both academic and grey literature. The analysis examines scholarly articles, policy documents, and conceptual frameworks to identify key strengths, weaknesses, and gaps, focusing on how well these frameworks incorporate grassroots participation, social cohesion, and community-led initiatives. By synthesising the findings, the analysis identifies significant limitations and highlights opportunities for developing more inclusive and adaptive strategies. Notably, many existing frameworks fail to prioritise the social dimensions of community engagement in flood resilience. While they emphasise technical solutions, institutional collaboration, and ecological benefits, they often neglect critical aspects like grassroots involvement, social cohesion, and community-driven initiatives.

Frameworks like Vanderhorst *et al.* (2024) and Xu *et al.* (2023) focus on infrastructure and economic resilience but neglect citizen engagement and social cohesion. Ma *et al.* (2023) and Muzamil *et al.* (2022) emphasise technical and institutional solutions yet overlook psychological support and public involvement. Takin *et al.* (2023) and Tariq *et al.* (2021) highlight governance and infrastructure but fail to promote community autonomy or social resilience. Similarly, Peck *et al.* (2022) prioritise ecosystem-based solutions but overlook social networks and social capital. Zhong *et al.* (2020) emphasise institutional and technological solutions giving less attention to social dimensions. Policy documents, such as the Barnet Council report (2023) and West Sussex County Council strategy (2021), further illustrate this gap. Barnet’s approach relies on consultation but provides little empowerment, limiting community decision-making power. Similarly, West Sussex emphasises technical interventions, but ultimate decisions remain with the local authority, limiting community ownership and perpetuating top-down control. Overlooking these social dimensions limits communities' ability to prepare for, respond to, and recover from floods effectively. Table 1 summarises the gaps in existing frameworks highlighting the need for inclusive, adaptive, and community-driven solutions.

Table 1: Analysis of current community engagement frameworks for flood resilience

Reference	Strengths	Weakness/Gaps	Methodology
Vanderhorst <i>et al.</i> (2024)	<ul style="list-style-type: none"> <li>Focus on institutional collaboration and infrastructure solutions</li> </ul>	<ul style="list-style-type: none"> <li>Lacks focus on grassroots resilience and community-led initiatives</li> <li>Limited social support and citizen engagement</li> </ul>	Empirical Study, Case-Based Analysis
Barnet Council (2023)	<ul style="list-style-type: none"> <li>Emphasises technical interventions</li> </ul>	<ul style="list-style-type: none"> <li>Limited community-based initiatives</li> </ul>	Policy Review

		<ul style="list-style-type: none"> <li>▪ Consultations without full empowerment</li> </ul>	
Xu <i>et al.</i> (2023)	<ul style="list-style-type: none"> <li>▪ Emphasis on structural/economic resilience</li> <li>▪ Reliance on government investments/interventions</li> </ul>	<ul style="list-style-type: none"> <li>▪ Limited attention to the social and behavioural dimensions</li> </ul>	Empirical Study, Mixed Methods
Ma <i>et al.</i> (2023)	<ul style="list-style-type: none"> <li>▪ Heavy emphasis on structural components</li> </ul>	<ul style="list-style-type: none"> <li>▪ Weakness in addressing psychological support and community cohesion</li> </ul>	Qualitative Study, Case Analysis
Takin <i>et al.</i> (2023)	<ul style="list-style-type: none"> <li>▪ Emphasises collaborative governance</li> <li>▪ Integrates green infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>▪ Minimal behavioural exploration</li> <li>▪ Limited community autonomy</li> </ul>	Empirical Study, Theoretical Review
Peck <i>et al.</i> (2022)	<ul style="list-style-type: none"> <li>▪ Heavy emphasis on ecosystem and engineering solutions</li> <li>▪ Focus on Ecological Benefits and advocate nature-first solutions</li> </ul>	<ul style="list-style-type: none"> <li>▪ Social cohesion ignored</li> <li>▪ Limited engagement with social capital and community networks</li> </ul>	Conceptual Framework
Muzamil <i>et al.</i> (2022)	<ul style="list-style-type: none"> <li>▪ Focus on institutional and technical solutions</li> </ul>	<ul style="list-style-type: none"> <li>▪ Limited community role</li> <li>▪ Lack of public awareness/involvement</li> </ul>	Policy Framework, Literature Review
West Sussex County Council (2021)	<ul style="list-style-type: none"> <li>▪ Focus on technical adaptation and flood infrastructure investment.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Limited community engagement</li> <li>▪ Top-down control</li> </ul>	Policy Review
Tariq <i>et al.</i> (2021)	<ul style="list-style-type: none"> <li>▪ Heavy focus on physical infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>▪ Limited focus on social resilience and community engagement</li> </ul>	Q-method, Evaluative Framework
Zhong <i>et al.</i> (2020)	<ul style="list-style-type: none"> <li>▪ Reliance on institutional and technological solutions</li> </ul>	<ul style="list-style-type: none"> <li>▪ Limited input from residents</li> <li>▪ Lower prioritisation of social dimensions</li> </ul>	Mixed Methods, Case Study
Bulti <i>et al.</i> (2019)	<ul style="list-style-type: none"> <li>▪ Many frameworks focus heavily on infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>▪ Many frameworks overlook social support</li> </ul>	Review Study

### 3 Reimagining Community Engagement

The discourse on community engagement in flood resilience increasingly emphasises inclusive, collaborative, and context-sensitive approaches. Defined as fostering relationships that enable stakeholders to collectively address well-being (WHO 2020), community engagement promotes ownership and empowerment in disaster management. This aligns with the Sendai Framework for Disaster Risk Reduction, which advocates an "all-of-society" approach to planning and recovery, prioritising marginalised voices and social equity (UNDRR 2015). However, the term "community engagement," often used by institutions and public bodies, can carry negative connotations when it reflects poor practices where actions are done "to" communities rather than "with" them (Environment Agency 2021). Effective community engagement addresses root vulnerabilities, strengthens social cohesion, and ensures adaptive, inclusive resilience strategies (Nsobya *et al.* 2024).

Models like Arnstein's Ladder of Citizen Participation and the IAP2 Spectrum of Public Participation highlight the transformative potential of empowering communities in decision-making processes (Arnstein 1969; IAP2 2018). Both models demonstrate the shift from tokenistic engagement (e.g., informing or consulting) to collaborative approaches that grant communities' decision-making power. However, most flood resilience initiatives remain confined to lower engagement levels, failing to integrate local knowledge or address social dynamics effectively (Van Krieken and Pathirage 2019; Olatunji *et al.* 2024a).

Traditional flood resilience has focused on technical infrastructure. However, growing challenges from climate change and urbanization highlight the need for community-led strategies that integrate local insights, social networks, and cultural contexts (Olatunji *et al.* 2024a). Participatory approaches foster relevance, adaptability, and ownership, enhancing resilience outcomes (Dewa *et al.* 2023; Environment Agency 2022b; Olatunji *et al.* 2024a; Olatunji *et al.* 2024b). Yet, current frameworks often marginalise vulnerable groups, rely on tokenistic engagement, and lack mechanisms to fully integrate local knowledge, highlighting the need for more inclusive, community-led strategies (Nsobya *et al.* 2024; Olatunji *et al.* 2024a; Olatunji *et al.* 2024b; Savari *et al.* 2024). The Environment Agency's FCERM 2026 Roadmap advocates empowering communities to share responsibility, emphasising inclusive, adaptive engagement to address unavoidable flood risks (Environment Agency 2022a).

Reimagining community engagement in flood resilience involves moving beyond tokenistic practices to establish genuine partnerships that prioritise inclusivity, collaboration, and empowerment (Johnston *et al.* 2024). This shift requires prioritising social factors, including the integration of local knowledge, the strengthening of social networks, and the fostering of shared responsibility. Placing communities at the centre of decision-making fosters equitable, adaptive, and sustainable practices (Nsobya *et al.* 2024; Olatunji *et al.* 2024b).

### **3.1 Social Drivers in Community Engagement for Flood Resilience**

Achieving a vision of community engagement rooted in social networks depends on the interplay of internal and external social drivers. While these drivers are distinct, they are also interdependent (Nsobya *et al.* 2024). Internal drivers focus on grassroots dynamics, empowering communities to act collectively and adaptively. This aligns with Arnstein's Ladder of Citizen Participation and the IAP2 spectrum, which emphasise local ownership and decision-making (Arnstein 1969; IAP2 2018). External drivers complement these efforts by addressing resource gaps, institutionalising support mechanisms, and ensuring scalability and sustainability. Since communities operate within broader socio-political and economic contexts, external factors are essential for integrating local knowledge into wider flood management activities (Kamarudin *et al.* 2022; Nsobya *et al.* 2024). Self-organisation, exemplified by the UK Government's policy of promoting self-reliance within communities amidst limited public resources, underscores the importance of external support in bridging gaps and ensuring equity (Nsobya *et al.* 2024).

#### *3.1.1 Internal Drivers*

Internal drivers are central to fostering inclusive and sustainable engagement. Social cohesion and social capital foster trust, collaboration, and mutual support. Bonding ties strengthen relationships within communities by building closer connections among members. Bridging ties connect diverse groups, while linking ties establish networks between communities and external resources, enabling access to broader support and opportunities (Nsobya *et al.* 2024). These benefits, however, rely on inclusivity, as excluding marginalised groups risks perpetuating inequities (Bayili 2024). Local knowledge complements social capital by providing context-specific insights, allowing for culturally relevant and practical flood risk solutions (Xu *et al.* 2023; Vanderhorst *et al.* 2024). This expertise

fosters co-creation, ownership, and trust. However, it is often overlooked in favour of top-down interventions, which erode community engagement and trust (Nsobya *et al.* 2024). Education and capacity building further empower communities by equipping them with skills such as early warning systems and preparedness training while addressing barriers like poverty, gender, and disability (Pelone 2024; Vanderhorst *et al.* 2024). Leadership ties these drivers together by mobilising resources, fostering inclusivity, ensuring transparency, and guiding collective action (Dwirahmadi *et al.* 2023; Ridzuan *et al.* 2020).

### 3.1.2 External Drivers

External drivers provide critical structural, financial, and technological support to complement internal efforts. Policies on land use and flood protection establish essential guidelines but risk alienating communities when implemented through top-down, standardised approaches (Environment Agency 2021; Karki 2019). Collaborative governance models involving NGOs, private stakeholders, and local authorities promote shared responsibility and alignment with local priorities, fostering community-centred solutions (Dewa *et al.* 2023; Driessen *et al.* 2018; Osei-Kyei *et al.* 2023). Equitable funding mechanisms, like the UK’s Flood Re programme, show how financial support can bridge resource gaps and aid vulnerable populations (House of Commons Committee of Public Accounts 2023). Technology transfer, including tools like GIS and predictive modelling, enhances engagement by integrating local insights with scientific tools. However, disparities in access to training and infrastructure necessitate inclusive capacity-building programs that blend indigenous knowledge with modern approaches (Vanderhorst *et al.* 2024). Collaborative networks that connect communities, governments, and academia play a pivotal role in knowledge-sharing and adaptive learning, ensuring strategies remain robust and context-sensitive (Sarjiyanto 2024; Vanderhorst *et al.* 2024). Table 2 provides a concise summary of the internal and external drivers, highlighting their distinct but complementary roles in fostering meaningful and sustainable community engagement.

Table 2: Social Drivers in Community Engagement for Flood Resilience

Driver	Role in Community Engagement	Type
<b>Social Cohesion and Social Capital</b>	Builds trust, collaboration, and mutual support, fostering inclusivity and preventing inequities (Bhatt 2023; Nsobya <i>et al.</i> 2024; Sarjiyanto 2024; Van Krieken and Pathirage 2019).	Internal
<b>Local Knowledge</b>	Provides culturally relevant and context-specific insights, fostering co-creation and ownership (Nsobya <i>et al.</i> 2024; Xu <i>et al.</i> 2023; Vanderhorst <i>et al.</i> 2024).	Internal
<b>Education and Capacity Building</b>	Equips communities with skills (e.g., early warning systems) while addressing barriers like poverty and gender (Pelone 2024; Vanderhorst <i>et al.</i> 2024).	Internal
<b>Communication</b>	Ensures transparency and trust, empowering communities with actionable information (Bayili 2024).	Internal
<b>Leadership</b>	Mobilises resources, bridges divides, and fosters proactive community unity (Dwirahmadi <i>et al.</i> 2023; Ridzuan <i>et al.</i> 2020).	Internal

<b>Government Policies</b>	Establishes guidelines but risks alienating communities through top-down approaches (Environment Agency 2021; Karki 2019; Vanderhorst <i>et al.</i> 2024).	External
<b>Collaborative Governance Models</b>	Encourages shared responsibility and aligns priorities through participatory decision-making (Bayili 2024; Dewa <i>et al.</i> 2023; Driessen <i>et al.</i> 2018; Osei-Kyei <i>et al.</i> 2023).	External
<b>Funding Mechanisms</b>	Ensures equitable resource distribution to support vulnerable populations (House of Commons Committee of Public Accounts 2023).	External
<b>Technology and Knowledge Transfer</b>	Integrates GIS and predictive tools with local insights, fostering hybrid approaches (Vanderhorst <i>et al.</i> 2024).	External

The interplay between internal and external drivers highlights the importance of a balanced approach to community engagement. Internal drivers, such as social cohesion, local knowledge, and leadership, empower citizens as co-leaders, fostering grassroots ownership and culturally relevant solutions. External support, however, is often essential to fill systemic gaps, supply resources, and institutionalise broader structures and mechanisms. External drivers, including policies, funding, and technology, can enhance internal efforts. However, they must complement rather than dictate local initiatives. Respecting internal autonomy while leveraging external resources is critical for avoiding disruptions to community dynamics and maintaining ownership (Sarjiyanto 2024). Poorly managed external interventions weaken engagement, while insufficient support leaves communities vulnerable. Harmonising these drivers promotes inclusive, effective, and context-sensitive strategies, fostering genuine partnerships and avoiding tokenistic engagement (Moore 2024). Social Network Analysis (SNA) provides a framework to bridge these gaps, integrating internal and external drivers effectively.

### 3.2 Introducing SNA in Enhancing Community Engagement in Flood Resilience

Social Network Analysis (SNA) facilitates collaboration, addresses power imbalances, and shifts engagement from consultation to co-leadership. This aligns with the Sendai Framework’s call for inclusive, all-of-society engagement (UNDRR 2015). SNA connects internal drivers, such as social capital and trust, with external factors like government policies, partnerships, and technology. This framework helps develop more cohesive and inclusive strategies. SNA maps relationships, communication flows, and resource connections to identify key actors, highlight gaps, and align local knowledge with institutional support. This strengthens community engagement efforts. Rooted in sociometry and graph theory, SNA originated with Moreno’s sociograms and has evolved to analyse social interactions and broader network structures. Metrics like centrality and density offer valuable insights into network functionality (Newman 2003).

Recent studies illustrate SNA’s practical applications: Shehara *et al.* (2019) show its role in bridging communication gaps and improving early warning systems, while Shirleyana *et al.* (2023), Banafa *et al.* (2024), and Chen *et al.* (2024) demonstrate its utility in identifying influential actors, evaluating community ties, highlighting underrepresented groups, and optimising governance networks for inclusivity and resource allocation. SNA thus provides a methodological foundation to harmonise internal and external efforts, fostering stronger, more equitable community engagement in flood resilience.

## 4 Findings and Discussion

Community engagement is widely recognised as crucial in managing flood risks but is often implemented superficially. Traditional approaches focus on technical solutions, neglecting local knowledge and community needs. This perpetuates top-down models and limits preparedness, response, and recovery (Nsobya *et al.* 2024; Van Krieken and Pathirage 2019). While Arnstein's Ladder of Citizen Participation and IAP2 spectrum advocate for the highest levels of engagement, practical implementation often falls short. Some scholars argue that these levels are idealistic and difficult to achieve in real-world contexts due to power imbalances and resource disparities (Driessen *et al.* 2018). Others, like Ekoh and Teron (2023), emphasise that achieving true partnership requires not only structural reforms but also a cultural shift in how communities and institutions interact.

The debate around the extent of community involvement is further complicated by diverging views on the roles of internal and external drivers. Internal factors like social cohesion and local knowledge foster trust and collective action, particularly when combined with scientific approaches (Bhatt 2023; Kamarudin *et al.* 2022; Savari *et al.* 2024). However, over-reliance on social cohesion or dominance by powerful stakeholders risks sidelining local voices (Cuaton and Su, 2020). Local knowledge is often overshadowed by scientific models, further diminishing community input (Fastiggi *et al.* 2021). Leadership plays a crucial role in mitigating these issues. Communities with strong leaders are more engaged, informed, and capable of aligning initiatives with local needs (Ridzuan *et al.* 2020). Effective leaders bridge internal dynamics and external stakeholders, inspire trust, and empower communities to take ownership of flood resilience strategies, creating cohesive and adaptive systems (Dwirahmadi *et al.* 2023; Ridzuan *et al.* 2020).

Similarly, external funding can impose conditions misaligned with community needs or values (Sarjiyanto 2024), often prioritising structural solutions. External drivers like government policies and funding are essential. However, they often conflict with participatory approaches, as top-down 'one-size-fits-all' strategies risk community alienation (Karki 2019). Participatory decision-making helps fill resource gaps by aligning strategies with local priorities and using community knowledge to create effective solutions (Dewa *et al.* 2023). After disasters, external support becomes essential to supplement the limited resources available within communities (Kamarudin *et al.* 2022). Tailored education and clear communication are essential for addressing the unique needs of different communities (Bayili 2024; Moore 2024). Training programs equip residents to manage risks on their own, reducing their dependence on outside support (Vanderhorst *et al.* 2024).

## 5 Conclusion and Further Research

The analysis highlights significant gaps in the social dimensions of community engagement frameworks, particularly in addressing grassroots participation, social cohesion, and community-led initiatives. While existing frameworks emphasise technical solutions, institutional collaboration, and ecological benefits, they often overlook the critical role of inclusivity and the integration of local knowledge and social networks. Bridging these gaps is essential to ensure communities can prepare for, respond to, and recover from floods effectively. The literature reveals a broad consensus on the importance of community engagement. However, there are diverging views on how it can be operationalised effectively. While some advocate for idealistic models of partnership and citizen control, others argue for more pragmatic approaches that balance internal strengths with external support. Tools like SNA represent a step forward in addressing these gaps. SNA offers a means to map and strengthen social connections, enhance participation, and integrate internal and external drivers within community engagement strategies. However, the successful implementation of SNA depends on addressing existing inequities and ensuring that all voices, particularly those of marginalised

groups, are heard. Bridging these gaps requires a paradigm shift toward inclusive, adaptive, and community-driven practices that genuinely empower local stakeholders. Future research should explore the operationalisation of SNA across diverse contexts to develop scalable and sustainable solutions for flood-affected communities.

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