



Mapping Power Dynamics in Local Climate Action: Policy Networks in the Climate Village Program of Pekanbaru City, Riau



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Abstract: The complex challenges of addressing climate change at the local level necessitate a nuanced understanding of the policy networks that shape climate governance. This study investigates the policy network surrounding the Climate Village Program (CVP) in Pekanbaru City, Riau, examining the roles of various stakeholders and the collective dynamics that underpin local climate resilience efforts. A mixed-methods approach was employed, integrating both qualitative and quantitative data, and utilising Social Network Analysis (SNA) with UCINET 6 software to map and analyse the relationships between key actors in the network. The results reveal that the Department of Environment and Hygiene (DLHK) of Pekanbaru City occupies the most central and influential position in the policy network, acting as the primary leader. The Pekanbaru City Government plays a pivotal intermediary role, coordinating interactions between stakeholders. Despite the use of a multistakeholder approach in policy development, the process is predominantly driven by government institutions, with limited participation from businesses and non-governmental organisations (NGOs). This study highlights the potential for expanding the role of the private sector and NGOs in local climate governance, while also advocating for the increased involvement of universities in the development and implementation of climate policy. The findings offer a model for enhancing multistakeholder collaboration in local climate policy networks, with implications for broader application in other regions. The insights gained could contribute to more inclusive, participatory, and successful climate action initiatives, potentially transferable and scalable across various contexts to improve local climate governance globally.

Keywords: Climate Village Program (CVP); Policy network; Social Network Analysis (SNA); UCINET 6; Local climate governance

1. Introduction

In a world where the fact of being human is very closely tied to our natural environment, it might seem that there has been too little time in history when humans have watched themselves develop and adapt, such as by taking care with their utilization of environmental resources from the beginning. That might be difficult to stomach in the age of climate change, but it appears inevitable. As an important environmental phenomenon, climate change causes threats to ecosystems around the world (Saputra et al., 2023a). The phenomenon has quickly seen repercussions become widespread, causing alarm among the watching public (Saputra et al., 2022). Climate change is defined as changes in the emission of greenhouse gases (GHGs) caused by both direct and indirect human activities, which have a detrimental impact on life on Earth. The changes in significant climate indices, including precipitation, temperature, moisture, wind, cloudiness, and evaporation, are easily observable.

To effectively mitigate the effects of climate change, it is imperative that society, the private sector, and government agencies work together in a coordinated manner to enhance climate resilience (Sufi et al., 2022). The current analysis cautions that this is a potential area of difficulty, as the government plays a crucial role in guiding a nation's development through policies aimed at tackling these popular issues. According to Anderson (1997), public policy refers to the choices and activities undertaken by government entities. Nevertheless, public policy

continues to be a "resource-based decision" as defined by Peterson & Bomberg (1999), meaning that it can be influenced by external circumstances and actors.

One of the programs initiated by the Indonesian Ministry of Environment and Forestry (KLHK) based on Decree No. 19/2012 to enhance community adaptation and local mitigation in reducing GHG emissions significantly against climate change impacts is called the CVP, locally known as ProKlim (Kurniawan et al., 2024). Adaptable features for coastal destinies like those described by Jyothi et al. (2023) are obligatory and should integrate policy at areas of different levels that exceed local or even national. Finally, collaboration among stakeholders is needed to establish new practices and resources that tackle climate change through the adoption of community-based interventions (Jyothi et al., 2023). In addition, our understanding of societal changes messes with the transfer of intergenerational knowledge to explain climate impacts (Timlin & Anapalli, 2022).

Long-term adaptation strategies to sea level rise include sustainability, but they still face social and economic challenges such as those identified by de Jong Cleynert et al. (2021). Communication and diversifying the climate risk environment are key to empowerment, which is a challenge faced by cities as major emitters in preparing for the resilient response (Klint et al., 2012). Communities' engagement in adaptation and mitigation activities lies at the core of ProKlim, a program for relieving climate change impact in Indonesia (Nurpeni et al., 2022). The idea is being built up gradually, with the aim of creating 10 thousand climate villages across 34 provinces by reaching into time frames that wrap in the year 2030. The program began in 2012 and will begin operating by 2017. In 2020, it was dedicated again, and in 2025, its progress was evaluated. Nation UN Paris Agreement 2030 NDC adaptations. The mapping of the spread of Climate Village locations in 34 provinces is shown in Table 1.

Table 1. Distribution of climate villages in Indonesia

No.	Province	Number of ProKlim Locations
1	Aceh	16
2	Bali	95
3	Banten	23
4	Bengkulu	28
5	Yogyakarta (DIY)	142
6	Jakarta	119
7	Gorontalo	0
8	Jambi	70
9	West Java	313
10	Central Java	196
11	East Java	142
12	West Kalimantan	28
13	South Kalimantan	47
14	Central Kalimantan	9
15	East Kalimantan	28
16	North Kalimantan	2
17	Bangka Belitung	0
18	Riau Islands	13
19	Lampung	11
20	Maluku	1
21	North Maluku	2
22	West Nusa Tenggara	45
23	East Nusa Tenggara	485
24	Papua	3
25	West Papua	3
26	Riau	200
27	West Sulawesi	24
28	South Sulawesi	186
29	Central Sulawesi	1
30	Southeast Sulawesi	22
31	North Sulawesi	24
32	West Sumatra	82
33	South Sumatra	94
34	North Sumatra	30
Total Climate Villages		2,484

Source: Directorate General of Climate Change Control, KLHK, 2023

Riau Province ranks third with 200 Climate Village (ProKlim) locations out of a total of 313 ProKlim sites, following East Nusa Tenggara (NTT) and West Java, which collectively host 485 ProKlim locations across seven provinces. Riau is a dedicated province in the fight against climate change, having consistently worked toward reducing GHG emissions. Through Instruction No. 01/NT-HK/I/2017, the Governor of Riau made an official

commitment to climate action. The implementation of the CVP in Riau has received direction, support, and assistance from various stakeholders.

The CVP in Riau Province has been quite extended. The data of the Riau Province Regional Office for Environment and Forestry shows that there are 282 ProKlim points scattered in several districts and cities. The goal is to create 400 Climate Village sites by 2024. Table 2 shows the number of Location Climate Villages in each district.

Table 2. Distribution of climate villages in Riau Province

No.	District/City	Number of ProKlim Locations
1	Pekanbaru City	17
2	Indragiri Hilir District	16
3	Rokan Hulu (Rohul) District	5
4	Rokan Hilir (Rohil) District	41
5	Indragiri Hulu District	13
6	Kepulauan Meranti District	3
7	Siak District	44
8	Bengkalis District	39
9	Pelalawan District	38
10	Dumai City	23
11	Kampar District	28
12	Kuantan Singingi (Kuansing) District	15
Total		282

Source: Department of Environment and Forestry, Riau Province, 2023

According to Table 2, it appears that Pekanbaru City ranks fifth in Riau Province with a total of seventeen Climate Village (ProKlim) positions. This research study focuses on the Pekanbaru city area, Riau province, which has a strategic role in implementing the CVP due to its high vulnerability to the impacts of climate change such as forest and land fires, floods, and changes in rainfall patterns. This condition has a direct impact on air quality, public health, and local economic stability. The CVP is expected to be able to increase community adaptation to climate change by strengthening environmental resilience and local resources. It also indicates the complexity of actor involvement in the CVP in Pekanbaru.

According to Pekanbaru Mayor's Instruction No. 67 of 2020 on the Guidance, Assistance, and Strengthening of CVP Locations, each subdistrict in Pekanbaru is required to have at least one Climate Village location at the minimum level of a neighborhood unit (Rukun Warga, RW). The distribution of ProKlim locations in Pekanbaru from 2020 to 2023 is shown in Table 3 below:

Table 3. ProKlim data in Pekanbaru City (2020-2023)

No.	Year	Locations Proposed	ProKlim Locations
1	2020	1 Location	1. ProKlim Kel. Tobek Godang, Kec. Tampan, Pekanbaru City
2	2021	2 Locations	1. ProKlim RW 03 Kel. Tobek Godang, Kec. Binawidya, Pekanbaru City 2. ProKlim RW 02 Kel. Tobek Godang, Kec. Binawidya, Pekanbaru City
3	2022	8 Locations	1. ProKlim RW 16 Kel. Tobek Godang, Kec. Binawidya, Pekanbaru City 2. ProKlim RW 07 Kel. Tobek Godang, Kec. Binawidya, Pekanbaru City 3. ProKlim RW 13 Kel. Bambu Kuning, Kec. Tenayan Raya, Pekanbaru City 4. ProKlim RW 06 Kel. Sidomulyo Timur, Kec. Marpoyan Damai, Pekanbaru City 5. ProKlim Pondok Pesantren Ibnu Al Mubarak RW 003, Kel. Agro Wisata, Kec. Rumbai Barat 6. ProKlim RW 04 Kel. Binawidya, Kec. Binawidya, Pekanbaru City 7. ProKlim RW 12 Kel. Umban Sari, Kec. Rumbai, Pekanbaru City 8. ProKlim RW 13 Kel. Umban Sari, Kec. Rumbai, Pekanbaru City
4	2023	2 Locations	1. ProKlim RW 06 Kel. Agro Wisata, Kec. Rumbai Barat, Pekanbaru City 2. ProKlim Kel. Sekip, Kec. Lima Puluh, Pekanbaru City, Riau Province GCF

Source: Department of Environment and Forestry, Riau Province, 2024

From Table 3, it is indicated that in 2020, Pekanbaru City had 13 locations for Climate Villages. However, this data reveals that the distribution of Climate Villages in Pekanbaru has yet to meet the target set by the instruction of the mayor, which states that in every sub-district, there should be at least one location of Climate Village. This points to the nature of actor-heavy programs like ProKlim in Pekanbaru, which are very complex. Typically, ProKlim implementation in Indonesia involves numerous parties. The Directorate General of Climate Change Control (Ditjen PPI) stated that the implementation of Climate Villages adopts four principles: synergy, integration, coordination, and leadership. In implementation, the Pekanbaru City Government engages many stakeholders in

this program. Including government sectors such as the Regional Development Planning Agency for Community Empowerment (BAPEDA), DLHK, Agriculture and Fishery Service, Food Security Service, Health Office, Public Works and Spatial Planning Agency (PUPR), Women's Empowerment and Child Protection Agency, and city district heads who are in Pekanbaru.

In detail, the authors elaborate, "academics" at higher education institutions became drivers of the CVP, especially those from Universitas Lancang Kuning and DPW LDII. Even though they play a role, their contribution to ProKlim is still considered small. The importance of universities is that they must implement "Tri Dharma" in higher education, which is under the mandate: service to society. Further, the absence of the participation of the business sector in ProKlim is very noteworthy, as it should play a leading role in the implementation of social responsibility.

Correspondingly, research also found that there has not been an involvement of civil society, NGOs, or mass media in the implementation and development of ProKlim within Pekanbaru City (Saputra et al., 2023b). Civil society and NGOs are much-needed stakeholders and implementers who directly support the actions concerning climate change within the field. Meanwhile, mass media is indispensable in getting the right information over the implementation of climate change initiatives. Although local communities are the most affected, their involvement in decision-making and policy implementation is still less structured. This is a challenge for community-based programs, as direct collaboration with communities is critical to long-term success.

This arises as a result of the absence of special provisions, e.g., a mayoral decree that should govern the Climate Village (ProKlim). Presently, the program is taken ahead only by the guidance of official instructions in the internal government's form of memoranda. Since climate change is a global phenomenon and poses a threat to the world's ecosystem, it relies on stakeholder's participation to see the success of the Climate Village (ProKlim) program. Policy networks will be very crucial in ensuring the successful implementation of ProKlim. A policy network is described by actors who are in the network and how they are related to one another (Saputra et al., 2021). Said networks, by nature, are heterogeneous, but this kind of heterogeneity presents resource exchanges that are key for the success of ProKlim in the conformation of policies. This research offers a more inclusive, collaborative approach based on network analysis in developing local climate policies, while also showing areas that still need improvement to make implementing the CVP more effective and sustainable.

2. Literature Review

The policy network in this study refers to the system of relationships between various actors who play a role in formulating and implementing the CVP policy. These actors include government agencies, academics, communities, and other sectors that are directly or indirectly involved in the program. The policy network is to identify and connect key actors who collaborate in climate change adaptation and mitigation efforts. By mapping this network, the study aims to understand how relationships between actors affect the effectiveness of policy implementation. Cross-sector collaboration is an important component of this study, which describes cooperation between government, communities, historians, and (hopefully) the private sector and NGOs. Cross-sector collaboration is seen as important to strengthen the response to climate change because environmental challenges require an inclusive and community-based approach.

The climate change impacts human life in an increasing way, and there is a need for deep understanding regarding the social dimensions to be reflected in policymakers to create adaptive policies. Regarding the positive influence of institutional trust in the climate change adaptation policy, according to Belay & Fekadu (2021), there will be the possibility of policy and governance interventions to build adaptive institutional capacity. Climate change policies need to be formulated in a manner comprehensive in scientific assessment, considerations of stakeholders, and the challenges in implementation (Secretariat of the United Nations Framework Convention on Climate Change, 2012). However, gaps tend to prevail between policy formulation and policy implementation (Khan et al., 2016). Bridging such gaps would require systematic frameworks, while in this case utilizing problem-solving models (Subirats, 2001), for an enhanced understanding of the complexities of climate change issues, consideration of stakeholder perspectives, and derivation of effective recommendations.

Public policy cannot rely only on one actor from the government sector since resources are not enough for one actor to handle and respond to the varied and dynamic needs of the public (Baumgartner & Jones, 2001). With this, the government is pushed to adopt an arrangement of partnership and collaboration with other stakeholders that range from fellow government agencies, the private sector, and community organisations (Wang et al., 2016). Key policy actors participating in governance include the government (state), the private sector, and civil society. They generate interactions that are also divisions of a structure that is called 'Good Governance', and all stakeholders need to be engaged. Good governance is increasingly giving way to multi-actor participation. (Etzkowitz & Zhou, 2017) introduced the 'Triple Helix' model, which stands for multi-actor collaboration with government, universities, and the private sector for innovation based on scientific knowledge.

The building of policy networks is easier to observe when power is distributed among multiple actors in a particular policy domain with the intention of enhancing the effectiveness of the respective policy. Delegation of

authority, power, tasks, and roles must accompany integration or coordination. Policy networks are groups of organisations that rest on the exchange and cooperation of human resources where two organisations or more get into bonds to achieve set goals. (Bevir & Richards, 2009; Kennis & Raab, 2003) further discussed policy networks.

In this study, Suwitri (2008) brings out the point of the difference that exists between the policy network and participation. As it were, policy networks involve not only the engagement of the stakeholders as actors but also the forging of mutual relationships within the framework of good governance consisting of the government; the private sector and the civil society play significant roles. The policy network strategy can indeed be utilized in different stages of activity, whether policy formulation, the implementation of the policy, or public services, for that matter. The policy network model applied in this study is the network-based policy formulation model by Van Waarden (1992).

From the perspective of the policy network approach, the many relationships of group representatives, bureaucrats, politicians, and other actors within systems of decision-making explain how political systems of different hues and forms process policies (Kickert et al., 1997). Policy decisions, from this perspective, flow from exchange, interdependence, and linkages between the government and its external actors. According to Rhodes (2017), policy networks are defined as formal institutions and informal relationships existing between the government and other actors, structured collectively through continuous negotiation of trust and interests in the creation and implementation of public policy.

The research concerning policy networks in the process of preparing the program for the Climate Village has to be carried out with the use of the SNA method. This study measures through SNA the involvement of the actors in the CVP at Pekanbaru, not only to seek collaboration but also the reality of the actors' interaction and partnerships taking place. The involvement of many parties in an inclusive policy network, including local governments, communities, academics, and the private sector, will strengthen the collaborative framework in this program.

3. Methodology

This study employs a mixed-methods approach, combining both quantitative and qualitative techniques to analyze and assess stakeholder involvement in the policy network for the formulation of the CVP in Pekanbaru City. The quantitative approach is used to identify the stakeholders and their connections within the policy network through

Meanwhile, the qualitative approach is applied to explain how actors are involved in the policy formulation process during the formulation phase. This research was conducted in Pekanbaru, the capital of Riau Province, Indonesia. The case study design allowed us to collect in-depth information about actors' involvement in the CVP in Pekanbaru City. Participants were selected using purposive sampling with a non-probability technique. This technique is appropriate for this study because we only need information from actors who are directly involved and have the in-depth knowledge needed for this (Table 4).

Interviews were conducted as a data collection tool. Data collection was carried out between February and June 2024. Interviews were conducted with various organisational actors to obtain the data and information needed. The right instrument for data collection is an interview guide. This guide includes a series of open-ended questions that form the basis for discussions between researchers and informants. After the interview, actors were asked to indicate other actors they collaborate with (whether they regularly exchange information or collaborate in their activities). Based on these data and criteria, a data matrix was created where 1 indicates that there is a relationship between two actors and 0 indicates that there is no relationship between two actors. The data collected from this matrix will form a network visualization using NetDraw from UCINET 6 (Borgatti et al., 2002).

Table 4. Stakeholders in the policy network of the climate village

Type	Name of Actor/Institution	Role
Local Government	DLHK, BAPEDA, Department of Agriculture and Fisheries (DPP), Department of Health (DINKES), Department of Public Works and Spatial Planning, Department of Public Housing, Department of Women's Empowerment and Child Protection (DPPPA), Department of Food Security (DKP)	Provider
Subdistricts	Kel. Umban Sari, Kel. Tabek Godang, Kel. Sidomulyo Barat, Kel. Tangkerang Labuai, Kel. Bina Widya, Kel. Bambu Kuning	Implementer
Accelerators	Universitas Lancang Kuning, DPW LDII	Accelerator

Source: Author's Analysis (2024)

This study adopts the SNA approach to analyze the involvement and roles of actors in the formulation of the CVP. According to Cronin (2016), SNA is a collection of methods for identifying and representing patterns of interaction among social entities. SNA investigates and analyzes the nature and patterns of interactions between different entities through graphical tools. These entities, or the actors under investigation, are represented as points,

which are known as nodes, while their relations are presented as lines, which are known as links, edges, or arcs (Cronin, 2016).

Most of the time, strategic positions within the network are taken up by the highly influential or salient nodes (Scott, 2011). One of the earliest approaches that helped to understand the position features of actor nodes within a network is the centrality of roles. Relationships between entities are measured based on the frequency of contact or other criteria set by the researcher.

In this study, two main criteria are used: magnitude and direction. Magnitude, on the other hand, refers to the frequency and intensity with which social interactions are taking place; that is, where an interaction is generated and on which target. In this research, the measurement of magnitude is captured through the process of information exchange and communication between the actors concerning the design of the CVP. Direction measures by whom the information is sent, as is usually shown, and to whom it is being sent, and is signified in the actor network with the employment of arrows.

4. Results and Discussion

Actors Involved in the CVP in Pekanbaru City

It is recognized that the CVP in Pekanbaru City involves 21 actors, namely the DLHK, BAPEDA, DPP, DKP, DINKES, PUPR, Department of Public Housing and Settlements (PERKIM), and DPPP. Other than the aforesaid, two organisations, that is, Universitas Lancang Kuning and DPW LDII, are also incorporated.

From the interviews and literature studies, there are two categories of stakeholders, as the following: (1) primary stakeholders and (2) supporting stakeholders. The first category names the central government represented by the Ministry of Environment as a primary stakeholder because the central government has legal standing to hold power on the CVP, as in Table 5 given below:

Table 5. Types and roles of actors in the CVP

Type	Name of Actor/Institution	Role	Objective
Secondary Stakeholder			
Local Government (Pemko)	DLHK, Pekanbaru City Government (Pemko), City Development Planning Agency, DPP, DKP, DINKES, PUPR, PERKIM, DPPP	Provider	Social Dimension
Subdistricts (Kelurahan)	Kel. Umban Sari (US), Kel. Tabek Godang (TG), Kel. Sidomulyo Barat (SB), Kel. Tangkerang Labuai (TL), Kel. Bina Widya (BW), Kel. Bambu Kuning (BK), Kel. Sidomulyo Timur (ST), Kel. Sungai Ukai (SU), Kel. Agrowisata (AW), Kel. Tampan (TN)	Implementer	Social and Economic Dimensions
Academics	Universitas Lancang Kuning, DPW LDII	Accelerator	Environmental and Scientific Dimensions

Source: Author's Analysis (2024)

The network of actors in the CVP in Pekanbaru City

Network of actors in the implementation process of the CVP as adapted to Pekanbaru City The arrows show the interactions or relationships between actors. A one-way arrow essentially means it is a non-reciprocal relationship, and two-way arrows mean that the actors have bilateral or reciprocal relations.

Figure 1 explains directed relationships between the actors of the system that describe directions of interactions among them using lines, showing possible flows of interactions, such as, for example, the role of related OPD institutions in interaction with other institutions. The Pekanbaru City Government, through the Environmental and Forestry Service (DLHK), plays a role as an implementer for making decisions and policy in assisting CVP with support with organisational strength, information resources, and technical. The CVP emphasizes the importance of collaboration between stakeholders in overcoming climate change, where local government agencies have an important position (Saputra et al., 2022). Effective public policy implementation and climate action depend on collaborative governance, where multiple stakeholders engage in decision-making, fostering a comprehensive understanding of climate issues and enhancing program adaptability (Dorisman et al., 2021; Mees et al., 2019; Nurani & Wike, 2021; Samnuzulsari et al., 2023). Collaborative approaches also strengthen stakeholder commitment to climate initiatives by facilitating knowledge sharing and co-production processes, leading to improved engagement and ownership (Adegun & Olusoga, 2020; Chambers et al., 2021; Hallberg Sramek, 2023; Hartter et al., 2020). Local governments play a pivotal role in this collaboration, adopting flexible roles to address diverse stakeholder interests and capacities, which enhances accountability and transparency in governance (Austhof et al., 2020; Mees et al., 2019; Zeho et al., 2020). Besides, the sub-district government and academics

give birth to policy drivers and implement the CVP, while the sub-district government becomes a potent implementer.

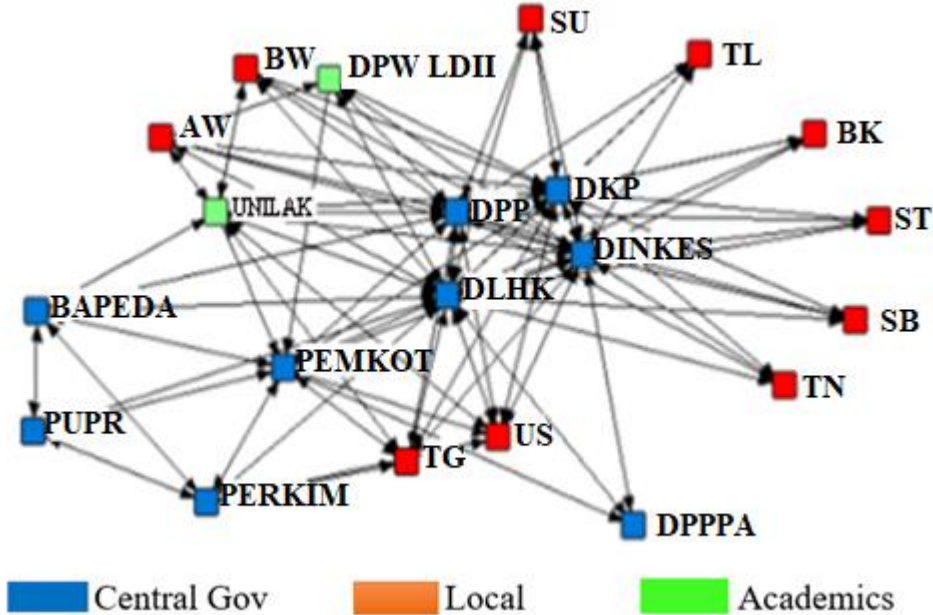


Figure 1. Network of actors in the Kampung Iklm Program in Pekanbaru City
 Source: Data Analysis, 2024

Network Density

The density of the network reveals its structure. Network density refers to the number of links or ties in an actual network compared to all possible links. This can be seen in Table 6 below:

Table 6. Network density of actors in the CVP

Density Measure	Average Matrix Value
Density	0.402
Number of Ties	169
Standard Deviation	0.4904
Average Degree	8.048

Source: Data Analysis, 2024

For example, the CVP in Pekanbaru shows a network density of 0.402, which means less than half potential ties between actors used; it indicates relatively few connections that can reduce its performance. This is a very low density, with 169 ties and a standard deviation of 0.4904, which indicates that stronger collaboration might be necessary in order to better adapt to climate change together as municipalities. Network density is important for how social networks function, including climate information transfer and resource flow (Romsdahl, 2011). A range of studies has highlighted how the robustness of climate networks may depend critically on both their structure and density, which have been analyzed using probabilistic graphical models in order to understand causal relationships among various actors within a climate (Ebert-Uphoff & Deng, 2012). Enhanced networking in the CVP would enhance communication and collaboration and ultimately further increase climate-change challenge capacity to address, as argued by wider research of successful organisational efforts on communicating on notice reduction (Clark et al., 2023).

Degree Centrality

Table 7 presents the descriptive statistics for degree centrality, indicating that there are 21 actors in the network. However, only a few individuals exhibit high centrality. Notably, the DLHK stands out, as shown in Table 7, with the highest degree centrality, scoring 20 in both Outdegree (sending information) and Indegree (receiving information). In other words, DLHK communicates with 20 actors in the network and receives information from the same number.

Table 7. Degree centrality values

No.	ID	Outdeg	Indeg	Noutdeg	Nindeg
1	DLHK	20	20	100	100
2	PEMKOT	10	12	50	60
3	BAPEDA	6	5	30	25
4	DPP	17	17	85	85
5	DKP	16	16	80	80
6	DINKES	17	17	85	85
7	PUPR	4	4	20	20
8	PERKIM	6	6	30	30
9	PPPA	3	3	15	15
10	US	7	7	35	35
11	TG	7	7	35	35
12	SB	4	4	20	20
13	TL	4	4	20	20
14	BW	5	5	25	25
15	BK	4	4	20	20
16	ST	4	4	20	20
17	SU	4	4	20	20
18	AW	6	6	30	30
19	TN	4	4	20	20
20	UNILAK	9	9	45	45
21	DPW LDII	6	5	30	25

Source: Data Analysis, 2024

The degree centrality analysis of the 21 actors in the CVP reveals that only a small subset of members exhibit significantly high connectivity, as reflected by this indicator, which demonstrates their effectiveness in facilitating information exchange. Among them, the DLHK stands out, with a score of 20 in Outdegree. The Indegree score of DLHK also places it at the most central position within the network, as indicated in the TBM system table for its components. The broker role of DLHK is further reinforced by its central position, enabling it to serve as a critical intermediary for disseminating information among the 20 other actors, managing knowledge flows, and acting as a bridge or broker (Borgatti & Li, 2009). Given that the network's effectiveness relies on seamless information sharing to enhance collective service capacity, this central role is vital for all participants (Pahl-Wostl, 2009). Furthermore, DLHK's connections align with the theory of Granovetter (1973) of weak ties, strength, and diverse linkages, which provide access to different perspectives-an essential factor in shaping informed climate policy decisions in Pekanbaru.

Table 8. Eigenvector Values

Actor ID	Eigenvec	Neigenvec
1 DLHK	0.380	53.726
2 PEMKOT	0.273	38.575
3 BAPEDA	0.163	23.120
4 DPP	0.351	49.601
5 DKP	0.336	47.517
6 DINKES	0.345	48.777
7 PUPR	0.094	13.270
8 PERKIM	0.131	18.509
9 PPPA	0.099	13.978
10 US	0.205	29.056
11 TG	0.205	29.056
12 SB	0.140	19.779
13 TL	0.140	19.779
14 BW	0.165	23.400
15 BK	0.140	19.779
16 ST	0.140	19.779
17 SU	0.140	19.779
18 AW	0.184	25.993
19 TN	0.140	19.779
20 UNILAK	0.258	36.543
21 DPW LDII	0.185	26.176

Source: Data Analysis, 2024

Eigenvector

The eigenvector approach provides a centrality measure that identifies who is central overall in the network. Eigenvector centrality takes into account the extent each other actor is globally far from others, i.e., in simple terms, how important an actor is based on his connections to more central actors. This can be seen in Table 8.

The eigenvector values of 21 actors, including the policy network and CVP, are displayed in Table 8. The table reveals that DLHK (0.380) has a much higher value compared to other eigenvectors, indicating its greater influence on community carbon reduction actions (programs/initiatives). Next in order are the Department of Agriculture and Food Security (DPP) at 0.351, followed by DINKES (score 0.345) and DKP (Department of Marine Affairs and Fisheries; score: 0.336), indicating DLHK is on top/easy to set climate policies es hierarchically. Its significance in dealing with climate change mitigation is related to broad authorities on environmental management of DLHK (Adlin, 2021). The participation of DPP, DINKES, and DKP underlines the cross-cutting character of climate policy framework fill in farming (sub-system) with public health system as well as maritime resources management that effect on community resilience development has also been confirmed by Suci et al. (2023).

The selected departments involved in community empowerment and education are indispensable for the success of the CVP, which further illustrates the significance of local actors as drivers within climate adaptation (Demartoto, 2022). Collaboration here nurtures a common experience and some kind of unity amidst the realization we (sometimes) must act together to address climate risks (Runhaar et al., 2018).

Closeness Centrality

It is the smallest distance that a node has to reach every other in relation to the network. The lower the better; that means an actor is near other actors. It reports the minimum distance inwards that other actors communicate information to an actor and the minimum out of distance through which it communicates with others. This can be seen in Table 9 below:

Table 9. Closeness values

Actor ID	inFarness	outFarness	inCloseness	outCloseness
1 DLHK	20.000	20.000	100.000	100.000
4 DPP	23.000	23.000	86.957	86.957
6 DINKES	23.000	23.000	86.957	86.957
5 DKP	24.000	24.000	83.333	83.333
2 PEMKOT	28.000	30.000	71.429	66.667
20 UNILAK	31.000	31.000	64.516	64.516
11 TG	33.000	33.000	60.606	60.606
10 US	33.000	33.000	60.606	60.606
8 PERKIM	34.000	34.000	58.824	58.824
18 AW	34.000	34.000	58.824	58.824
14 BW	35.000	35.000	57.143	57.143
21 DPW LDII	35.000	34.000	57.143	58.824
3 BAPEDA	35.000	34.000	57.143	58.824
12 SB	36.000	36.000	55.556	55.556
7 PUPR	36.000	36.000	55.556	55.556
19 TN	36.000	36.000	55.556	55.556
17 SU	36.000	36.000	55.556	55.556
13 TL	36.000	36.000	55.556	55.556
16 ST	36.000	36.000	55.556	55.556
15 BK	36.000	36.000	55.556	55.556
9 DPPPA	37.000	37.000	54.054	54.054

Source: Data Analysis, 2024

Understanding the inCloseness and outCloseness systems can predict how information flow occurs within this network, especially that related to the Pekanbaru City CVP. InCloseness (appropriate for InDegree measures, which investigate a strength as recognizable with others and is based upon the contrasts in power between two actors because of their heartiness to exchange sources such that an actor can reach out to all other actors; or using geodesic path distances are considered to gauge cohesion among networks) (Denton, 2016). Instead, outCloseness is intended to denote the information dissemination capability of an actor and thus a mediator role between interaction or collaboration among other functional actors (Lin et al., 2023). People who combine both a high score of inCloseness and outCloseness are called hybrid conduits: they can mobilize resources, making them effective influentials to help understand the ability of knowledge spreading (Liou et al., 2017). Connected to Climate Village, a different group program now supplied 5 main actors. Categorized of DLHK, DPPKPLH, and CLA National Secretariat (2011) with solid capacities as the premier sections for obtaining similar information, they consist of DKP, PEMKOT, and also DINKES. You get companionship places from among these stakeholders, such as

According to Kurniawan et al. (2024), this interpretation of the results is consistent with Wu et al. (2020), which underline this role of freely flowing information in combination with physical interventions as a key determinant influencing COVID-19 burden and mortality when kept up from an environmental perspective, visualizing solution attributes. These interventions in turn require the inter-institutional and interdisciplinary cooperation efforts of governmental as well as non-governmental regimes.

Betweenness

Betweenness centrality is a measure of the amount of linkage between structurally equivalent actors, with greater values indicating that an actor mediates information in their network. Betweenness centrality captures the extent to which actors are brokers. This can be seen in Table 10 below:

Table 10. Betweenness values

Actor ID	Betweenness	Betweenness
1 DLHK	101.979	26.838
6 DINKES	46.179	12.152
4 DPP	44.745	11.775
5 DKP	33.845	8.907
2 PEMKOT	16.902	4.448
20 UNILAK	4.219	1.110
8 PERKIM	2.519	0.663
11 TG	2.043	0.538
10 US	2.043	0.538
3 BAPEDA	1.960	0.516
18 AW	0.400	0.105
21 DPW LDII	0.167	0.044
7 PUPR	0.000	0.000
12 SB	0.000	0.000
9 DPPPA	0.000	0.000
14 BW	0.000	0.000
17 SU	0.000	0.000
13 TL	0.000	0.000
19 TN	0.000	0.000
15 BK	0.000	0.000
16 ST	0.000	0.000

Source: Data Analysis, 2024

Table 10 shows that the DLHK is a crucial connector in Pekanbaru City's Climate Village policy network, with an extremely high betweenness score of 101.979; this value exceeds other actors, including DINKES or Planning Agency for Regional Development (BAPPEDA), by scoring only at respectively [sic] 46.179 and 44.745. This dominance illustrates an important role of DLHK as a bridge institution linked among stakeholders; they are in essence shoulder-to-shoulder with an undercontrol dominator, which means it is one center of gravitation for environmental governance (Brockhaus et al., 2014; Cristofoli et al., 2019; Leifeld, 2016). A high betweenness value indicates that the DLHK is the crucial link in controlling both information and resource flow, a role common to central actors in governance networks more generally (Cristofoli et al., 2019; Locatelli et al., 2020), but particularly so when stakeholder collaboration becomes necessary (Ombagi et al., 2023). More broadly, this bridging role demonstrates the importance of inter-agency cooperation in addressing complex policy challenges such as climate change (Barbi & Da Costa Ferreira, 2016; Gore, 2010; Pickering et al., 2015). This success can then be seen as the effect of a strategic positioning within the network that allows DLHK to carry out relationships and cooperation between different entities, improving also in substance climate initiatives effectiveness in Pekanbaru City (Ding et al., 2024; Ingold & Varone, 2012; Kim, 2013; Kukkonen et al., 2018; Zambianchi & Biedenkopf, 2024). This highlights the importance of identifying and promoting these influential actors for successful environmental governance results. As a core actor, DLHK plays a major role in formulating policies, setting priorities, and coordinating all activities in the program. This role allows DLHK to be a leader that directs other actors in the policy network, such as local governments, academics, and communities, to be involved harmoniously in the CVP. DLHK has a central position in the network that makes it a center for information distribution. This position allows DLHK to control and direct the flow of communication, thus ensuring that relevant information and policy guidelines are distributed to all actors in the network effectively and consistently. This is very important in maintaining alignment of goals and approaches between the actors involved. DLHK, as a core actor, can provide technical direction and support needed by implementing actors in the field. This helps clarify the roles of each actor and prevents duplication or overlap in tasks. As a result, policy implementation becomes more structured and efficient.

Policy Network in the Formulation of the CVP in Pekanbaru City

Actors, function, structure (institutionalization), rules of conduct, power relations, and actors' strategies are different dimensions of the network that are applied to a policy analysis by observing the policy formulation process based on a model network.

Actors

The actors, or rather participants in a network, are the first component. These actors are individuals or organisations, often representing specific groups of interests in the policy network. This can be seen in Table 11 below:

Table 11. Description of actors in the formulation of the CVP policy

Informant	Actor
Staff of the DLHK	Government (DLHK, Pekanbaru City)
Head of Tobek Gadang Subdistrict	Government (Tobek Gadang Subdistrict)
Head of RW 03, Tobek Gadang	Community Leader
Academic	Faculty of Administrative Science (Universitas Lancang Kuning)

Source: Author's Analysis, 2024

The Mayor of Pekanbaru has released No. 67 of 2020, an extended policy framework that involves various local government agencies, the Department of Environment, district and subdistrict governments, along with study centers from Universitas Lancang Kuning and DPW LDII, in the implementation of the CVP. The various actors within the government are collaborating to address climate change through a localized approach (Adlin, 2021). Yet, crucially, the framework does not include business sector actors, even though they are also key change agents with resources and innovative potential for achieving that environmental sustainability transition (Saputra et al., 2022). Furthermore, the involvement of academic institutions in the BLH LDII study by DPW and the Faculty of Administrative Science at Universitas Lancang Kuning can significantly contribute to the institutionalization of environmental accountability among the public (Suci et al., 2023). Existing literature suggests that educational institutions can foster the growth of grassroots environmental movements by activating community engagement, acting as a venue for knowledge dissemination, and spreading climate change policies through opinion leaders within these institutions. According to Luthfia & Alkhajar (2020), educational institutions have the potential to stimulate community engagement and serve as a platform for the dissemination of knowledge, thereby promoting the growth of grassroots environmental movements. As a result, engaging the business sector and educational institutions more deeply in the CVP could further strengthen climate strategies within Pekanbaru City.

Function

Figuring out the function of network-based policy formulation is another aspect that would be needed. Function of the actor in terms of CVP policy formulation, which is done by Pekanbaru City Ocean Governance Council Network as a Medium that Generates Communication Flows. The Pekanbaru City Government works by serving as a coordination or regulatory actor of stakeholders in terms of cooperation among all entities that are responsible for climate change reduction activities on their work towards GHG emissions contributed prevention commitment. It is an action that can only be accomplished jointly by all the leading sectors on their best-efforts basis. This can be seen in Table 12 below:

Table 12. Functions of actors involved in the policy network for formulating ProKlim policy

Informant	Function
Staff of the DLHK	<ul style="list-style-type: none"> • Select proposed ProKlim locations from districts/subdistricts • Conduct field verification of candidate ProKlim locations • Perform monitoring and evaluation
Head of Tobek Gadang Subdistrict	Conduct data collection of potential ProKlim locations in the working area
Community Leader (RW 03, Tobek Gadang)	Conduct data collection
Faculty of Administrative Science (Universitas Lancang Kuning)	Provide guidance and assistance

Source: Author's Analysis, 2024

Various actors have different roles in the policy formulation process of addressing the CVP, corresponding to each actor as their duties/antlringing. In addition to this central role, the CVP builds upon and helps coordinate ongoing work by relayers in nine subdistricts throughout Sintang. This highlights the necessary involvement of governmental agencies in environmental governance for their expert capacity and regulatory power that are indispensable for proper policy implementation (Jabłoński & Stempki, 2018). Field accelerators are the sub-

district government layer that is charged with adapting policies to local needs so as to enhance programmatic relevance and effectiveness (Çeler & Serengil, 2023). This decentralized and best-practice governance approach for designing environmental policy enables adaptation to local biophysical, social, and cultural contexts that help preserve the functioning of SESs (Mooney & Sahingur, 2021). Strategic partners like academic institutions offer invaluable insights and can act as a conduit between the government body and the citizens. It is important, considering that their roles generally include community service and social outreach programs that are used for increasing the consciousness of climate change and public involvement (Silva et al., 2019). In addition to the Bard College network, academics can play an important role in policy-making by developing scientific knowledge for decision-making and translating information into actionable steps to combat climate change (Christensen et al., 2016; Hristov et al., 2021).

Structure

Structure of a policy network (the third key element): the relationships among actors involved in a decision process. It is vital to understand and explain the network dynamics. This can be seen in Table 13 below:

Table 13. Description of the policy network structure in ProKlim policy formulation

Actor	Structure
DLHK	No structure
Subdistrict of Tobek Gadang	No structure
Community Leader (RW 03, Tobek Gadang)	No structure
Academic (Faculty of Administrative Science, Universitas Lancang Kuning)	Structured (SK)

Source: Author's Analysis, 2024

In the formulation of a policy network in the CVP, essentially it can describe where policies are situated. In the case of the CVP, there is no specific structure in their policy network so that sliding interactions occur and bring about problems for horizontal collaboration among stakeholders (Deslatte et al., 2020). Winengan (2019) explained that the organisation or bureaucracy of key government actors such as the DLHK and sub-district governments is still immature, resulting in ineffective implementation and monitoring. By contrast, academic institutes are practice partners; by establishing more structured partnerships that include students in data collection, connecting theory and actual evidence can be a showcase for others (Adlin, 2021). This gap at the level of structure clearly points to broader problems in local governance where inclusivity is essential for a sustainable and effective policy network (Prosinger et al., 2016).

Institutionalization

Institutionalization is considered with the formal and tight properties of a network. The effectiveness of the policy network is conditional based on its form and features, but it becomes much more effective if an institutionalization has a higher level. Institutionalization: rules or decisions that guide policy formulation. This can be seen in Table 14 below:

Table 14. Policy network model in ProKlim policy formulation

Informant	Institutionalization
Staff of DLHK	Regulation of the KLHK No. 19 of 2012 on ProKlim
Subdistrict of Tobek Gadang	Regulation of the KLHK No. 19 of 2012 on ProKlim
Community Leader (RW 03, Tobek Gadang)	Pekanbaru Mayor's Instruction No. 67 of 2020 on Guidance, Assistance, and Strengthening of ProKlim Locations
Academic (Faculty of Administrative Science, Universitas Lancang Kuning)	Pekanbaru Mayor's Instruction No. 67 of 2020 on Guidance, Assistance, and Strengthening of ProKlim Locations
	Regulation of the KLHK No. 19 of 2012 on ProKlim

Source: Author's Analysis, 2024

Table 14 highlights the institutionalization of the policy network, showing that the CVP policy is still based on national regulations, specifically the Regulation of the KLHK No. 19 of 2012 on ProKlim. In Pekanbaru, the policy is limited to Pekanbaru Mayor's Instruction No. 67 of 2020, concerning Guidelines, Assistance, and Strengthening in ProKlim Locations. This instruction outlines the roles and functions of actors in formulating the CVP policy and serves as the foundation for building the policy network. DLHK plays a significant role in climate change action, particularly in guiding, assisting, and strengthening ProKlim locations in Pekanbaru City. However, there is no specific regulation or Perda governing the CVP. The institutionalization of the program is based solely on Mayor's Instruction No. 67 of 2020, which remains an internal memo and lacks strong legal standing in the

formulation of ProKlim policy in Pekanbaru City.

Rules of Conduct

Networks are generally shaped by established norms or "rules of the game" that dictate interactions and exchanges within the network. These rules are influenced by how the actors perceive their roles, their attitudes, interests, and their social and educational backgrounds. This can be seen in Table 15 below:

Table 15. Rules of conduct in the ProKlim policy network

Informant	Rules of Conduct
Staff of DLHK	No specific rules of conduct
Head of Tobek Gadang Subdistrict	No specific rules of conduct
Community Leader (RW 03, Tobek Gadang)	No specific rules of conduct
Academic (Faculty of Administrative Science, Universitas Lancang Kuning)	Memorandum of Agreement (MoA) with Ditjen PPI

Source: Author's Analysis, 2024

The Conclusions section should clarify the main conclusions of the research, highlighting its significance and relevance. The limitations of the work and the directions of future research may also be mentioned. Please contain nothing not substantiated in the main text. Do not make this section a mere repetition of the Abstract.

The formulation of the CVP policy, as detailed in Table 15, reveals a lack of binding regulations, leading to inconsistencies in how different actors engage in the policy-making process. Academic actors are governed by a Memorandum of Agreement (MoA), while other stakeholders have to rely on ad hoc, role-specific guidelines that may lead to weak coherence and effectiveness of policy implementation. Grassroots involvement with important actors, such as the youth community in Malangan Village, who act essentially like initiators and motivators for climate adaptation workshops, also really support the decision-making process (Demartoto, 2022). Moreover, opinion leaders could act as bridges in actualizing the level of communication and acceptance of climate initiatives between government policies by local communities (Luthfia & Alkhajar, 2020). This lack of statutory regulation, however, could lead to an uncoordinated framework for policy implementation that may then result in ad-hoc measures that might adversely affect a wider climate action plan as found at the level of municipal engagement with climate policy (Bulkeley et al., 2011).

Power Relations

Power relations constitute one of the main properties that each policy network possesses, demonstrating who holds what portions of power in relation to other actors present inside a particular type of PP. This can be seen in Table 16 below:

Table 16. Power relations in the ProKlim policy network

Informant	Power Relations
Staff of DLHK	Balanced, based on respective duties and functions
Head of Tobek Gadang Subdistrict	Balanced
Community Leader (RW 03, Tobek Gadang)	Balanced
Academic (Faculty of Administrative Science, Universitas Lancang Kuning)	Balanced

Source: Author's Analysis, 2024

Table 16 represents a fair power-sharing network in the form of power relations between actors within the CVP's policy-making process. This balance is important in order for the program to be successful, so that everyone—from village governments to NGOs and community actors themselves—will play their roles better. The implementation of tourism and climate programs by village governments, for example, comes down to the ability to mobilize community resources (Areros et al., 2022). Additionally, they enhance communication and coordination among stakeholders, enabling more effective negotiation through the use of consensus design (Gebara et al., 2014), a crucial step in advancing REDD+ guidelines in Brazil. By experience, making the heads of villages and boards consultative has proven to be a strategic success in terms of creating policies that are community-based where balance power is achieved with effective decision-making, control testing processes, and an accountability system (Nain et al., 2024). However, opinion leaders are the most critical actors in these dynamics because of their role as catalysts enabling community commitment to environmental sustainability (Luthfia & Alkhajar, 2020). This demonstrates the example that could be set by "old" leaders like him, and, at the same time, it also implies a meaning of inclusive participation in community resilience to climate change (Demartoto, 2022).

Actors' Strategies

In this context, actors use the network to govern their interdependencies and realize outcomes appropriate for them given long-term collective action challenges. They shape the network or interact with it to address their needs and interests. The strategies employed by the actors in formulating policies for the CVP in Pekanbaru City. This can be seen in Table 17 below:

Table 17. Policy network model in ProKlim policy formulation

Informant	Actors' Strategies
Staff of DLHK	<ul style="list-style-type: none"> • Socializing the CVP at the subdistrict level
Head of Tobek Gadang Subdistrict	<ul style="list-style-type: none"> • Collecting data on potential ProKlim locations in their area
Community Leader (RW 03, Tobek Gadang)	<ul style="list-style-type: none"> • Collecting data at the neighborhood level • Acting as the implementer of the CVP
Academic (Faculty of Administrative Science, Universitas Lancang Kuning)	<ul style="list-style-type: none"> • Serving as a partner for other key actors • Acting as an advocate or mediator for the actors involved

Source: Author's Analysis, 2024

Table 17 describes the strategies used by different actors in formulating a policy on the CVP. The policy formulation of the CVP in Pekanbaru City is a game by actors who have their own strategies so that one actor can be dominant and in accordance with its interests. The DLHK helps to socialize the program on a subdistrict level so that all local stakeholders can learn about this new system. The subdistricts nominate the potential ProKlim location, while this proposal is approved by RW in terms of implementation on a field level. Public sector organisations, however, often have difficulty implementing environmental policies that extend beyond a statutory policy level because of some constraints (Hawrysz & Foltys, 2015). Academic actors act as transactors: providing the links between government structures and local behaviors or knowledge that allow for it to be properly understood; collected input from locals gives input into new legislation. As this role is fundamental to solving the complicated problems related to climate change (in line with social enterprises constitutionally being charged with addressing multi-faceted societal challenges) (Chang et al., 2022). In the following newsroom chapter about governmental organisation policy networks in more detail, we emphasize how it is necessary to have vested interests on board for creating effective and comprehensive strategies that go beyond reduction of emissions.

But the most obvious gap is the inadequate involvement of the business sector and NGOs. Environmental conservation works from the joint efforts of every citizen, and the mere absence of these vital stakeholders will be a detriment to success in this program (Zhao et al., 2022). Historically, this has been the domain of NGOs—key institutions for enabling stakeholder engagement and advocating about environmental issues. Because of the minimal participation, questions arise not only about the program's potential to produce holistic strategies accruing to communities most at risk (Liu et al., 2017). The CVP will have limited success in reaching its sustainability and resilience objectives in Pekanbaru City unless greater engagement with the business sector and NGOs is forthcoming.

This research can design a strategy to strengthen multi-sectoral collaboration in the CVP in Pekanbaru by expanding the involvement of the business sector and NGOs because of their important role in providing resources and innovation for climate change mitigation, so inviting these sectors to participate more deeply can increase the effectiveness of the program. Then increasing the role of universities such as Lancang Kuning University can strengthen this program through research, development, and community service, as well as becoming a mediator between the government and the community. Strengthening the policy network of more parties in an inclusive policy network, including local governments, communities, academics, and the private sector, will strengthen the collaboration framework in this program. Furthermore, the preparation of more specific and sustainable local policies, such as regional regulations or mayoral regulations, can clarify the role of each actor and provide a stronger legal framework for inter-sectoral collaboration. By implementing these strategies, the program can better respond to climate challenges and create a collaboration model that can be replicated in other areas.

5. Conclusions

This study provides important insights into multi-sector collaboration in the implementation of the CVP (ProKlim) in Pekanbaru City through a SNA approach. Key findings indicate that the DLHK is a key factor in this network policy, serving as the main liaison between stakeholders. The city government also plays a central role as an intermediary in the network policy. However, the interaction between the private sector and NGOs is still very limited, reducing the full potential of this collaboration. This study underscores the importance of expanding the involvement of the private sector and NGOs to strengthen the effectiveness of climate change mitigation and

improve local climate resilience. In addition, the role of universities can be enhanced through research, development, and mediation between the government and the community. This more inclusive collaborative approach can be a model for other regions to develop sustainable climate policies.

Although this study provides a rich picture of the ProKlim network policy, there are several limitations, including the limited geographic coverage in Pekanbaru and the lack of broad representation of stakeholders. The SNA approach also has weaknesses because it focuses more on structural aspects than on the dynamics of power and interests between actors.

In the future, more comprehensive research covering a wider area, participation of more diverse actors, and additional methods such as policy impact analysis can provide deeper insights. The preparation of specific local regulations, such as regional regulations or mayoral decrees, is also needed to strengthen the legal basis for collaboration between sectors. With a more inclusive and structured implementation, the CVP can be a role model for other regions to create adaptive, collaborative, and sustainable climate policies.

Data Availability

The data used to support the research findings are available from the corresponding author upon request.

Conflicts of Interest

The authors declare no conflict of interest.

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