Pentahelix Stakeholder Collaboration In Climate Change Mitigation In Bojonegoro District

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Abstrak

Penelitian ini bertujuan untuk mendeskripsikan peran dan kontribusi antar stakeholder pentahelix dalam proses kolaborasi pada pelaksanaan mitigasi perubahan iklim di Kabupaten Bojonegoro. Metode penelitian ini menggunakan pendekatan studi kasus dengan jenis penelitian deskriptif kualitatif. Teknik pengumpulan data dilakukan dengan wawancara, observasi, dan dokumentasi. Hasil penelitian ini menunjukkan pelaksanaan mitigasi perubahan iklim di Kabupaten Bojonegoro sudah baik, stakeholder yang terlibat sudah memainkan perannya dengan berkontribusi sesuai dengan tugas pokok dan fungsi nya masing-masing. Pemerintah sebagai leading sector berperan dalam penyusunan kebijakan serta memfasilitasi seluruh pemangku kepentingan. Komunitas berperan dalam pengembangan masyarakat dan menjadi jembatan antara masyarakat dan pemerintah. Bisnis berkontribusi dalam hal kemitraan dan pendanaan. Akademisi menjalankan dengan melakukan riset dan inovasi, selain itu media dalam hal ini berperan sebagai sumber informasi, edukasi, dan literasi bagi publik. Namun dalam pelaksanaan kolaborasi masih terdapat permasalahan pada hubungan antar stakeholder, yaitu terdapat ego sektoral atau mentalitas silo antar stakeholder yang cenderung tidak mau berbagi informasi dengan stakeholder lain. Hal ini menjadi salah satu tantangan dan hambatan dalam pelaksanaan mitigasi perubahan iklim di Kabupaten Bojoengoro.

Kata kunci: *Kolaborasi Pentahelix, Mitigasi, Perubahan Iklim.*

Abstract

This research aims to describe the roles and contributions of pentahelix stakeholders in the collaboration process on the implementation of climate change mitigation in Bojonegoro Regency. This research method uses a case study approach with a descriptive qualitative research type. Data collection techniques were conducted through interviews, observation, and documentation. The results of this study show that the implementation of climate change mitigation in Bojonegoro Regency is exemplary; the stakeholders involved have played their roles by contributing according to their respective main tasks and functions. The government, as the leading sector, plays a role in policy formulation and facilitates all stakeholders. The community plays a role in community development and becomes a bridge between the community and the government. Businesses contribute in terms of partnerships and funding. Academics run by conducting research and innovation; besides that, the media, in this case, plays a role as a source of information, education and literacy for the public. However, in the implementation of collaboration, there are still problems in the relationship between stakeholders; namely, there is a sectoral ego or silo mentality between stakeholders who tend not to want to share information with other stakeholders. This is one of the challenges and obstacles in the implementation of climate change mitigation in Bojoengoro District.

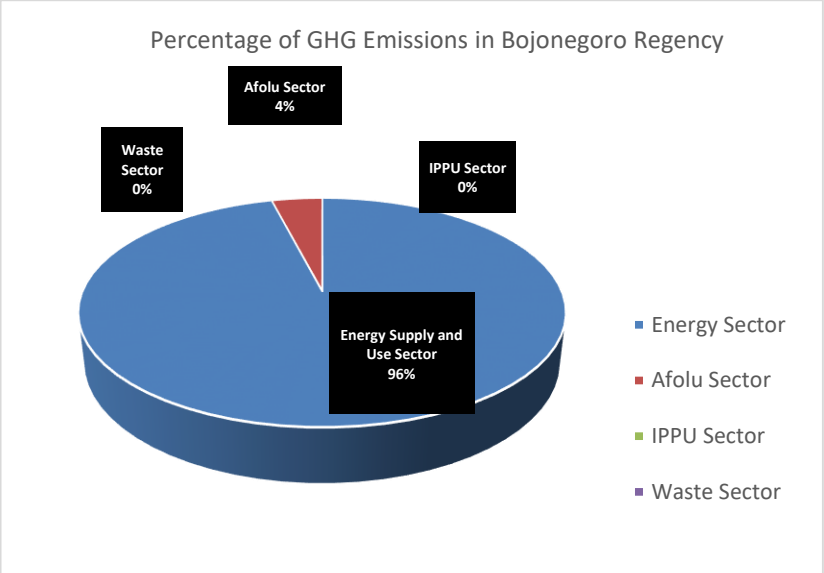
Keyword: *Pentahelix Collaboration, Mitigation, Climate Change.*

1. INTRODUCTION

Climate change is now a crucial issue that is currently a global concern because of its broad and increasingly tangible impacts. The erratic frequency of the dry season and rainy season affects the increase in the earth's temperature (global warming), high rainfall, and rising sea levels. Other severe natural disasters also have the potential to threaten the lives of all living things on earth, as well as the impact on various sectors that can hamper development in a country (Gina & Ketaren, 2023). One of the causes of

climate change is an increase in the concentration of greenhouse gas emissions in the atmosphere, including carbon dioxide, methane, nitrogen, and so on. Generally, greenhouse gases maintain the stability of the earth's temperature in the atmosphere. However, due to excessive human activity, significantly since the pre-industrial era, greenhouse gases have increased considerably, resulting in climate change.

Figure 1: Percentage of Greenhouse Gas Emissions



Source: Bojonegoro District GHG Emissions Inventory Preparation Document Year 2023

Based on the graph, the percentage distribution of GHG emissions in Bojonegoro Regency from several sectors, including the energy sector, the afolu sector, the IPPU sector, and the waste sector. The energy sector dominates the amount of GHG emissions in Bojonegoro Regency with a percentage of 96% or 27,617,352,483 Gg CO2/year. The energy sector is divided into two sub-sectors, namely, combustion of mobile fuel sources and combustion of stationary fuel sources. The combustion of stationary fuels amounted to 26,545,921,412 Gg CO2/year, which is a percentage of 62% of the total GHG emissions in the energy sector. These emissions are generated from the combustion of an industrial or business activity that produces residual gas combustion in the form of carbon dioxide, methane and nitrous oxide, one of which is an oil and gas company.

As one of the regencies with abundant natural oil and gas resources, 30 per cent of national oil and gas production currently comes from Bojonegoro Regency (Nugroho, 2024); oil and gas companies contribute the highest carbon emissions due to oil and gas extraction and processing activities (Linke et al., 2022). (Linke et al., 2022).. Of course, this is one of the factors driving the increase in carbon emissions in Bojonegoro Regency. Dandi Suprayitno, Head of the Bojonegoro Environmental Agency, explained that greenhouse gas emissions in Bojonegoro Regency in 2018 amounted to 3,631,687 tons of CO2eq and in 2022, emissions are projected to increase by 5,670,51 tons of CO2eq, and in 2023 it is now known that the amount of GHG emissions in Bojonegoro Regency has reached 27,617,354,728.077 Gg CO2. According to data from jatim.jpp.com, Bojonegoro Regency now occupies the number 2 district with the maximum temperature in East Java at 37 degrees Celsius. This shows that we have experienced a climate crisis, a critical problem that needs serious attention to minimise its impact. (Alviya et al., 2018)..

As a form of commitment to contributing to the reduction of greenhouse gas emissions, as mandated by Presidential Regulation No. 98 of 2021 concerning the Implementation of Carbon Economic Value for Achieving Internationally Determined Contribution Targets and Controlling Greenhouse Gas Emissions in National Development, as well as Indonesia's commitment written in the signing of the Paris Agreement in 2016, the Bojonegoro District Government seeks to build collaboration from various sectors in climate change mitigation efforts. This is expected to make active collaboration between parties to reduce carbon emissions as a form of mitigation against climate change in Bojonegoro Regency. (Dwirahmadi et al., 2023).. In addition, referring to Presidential Regulation No. 61/2011 on the National Action Plan for Reducing Greenhouse Gas Emissions (RAN-GRK) in Article 4 which states that the RAN-GRK is a reference for the community and other stakeholders in planning and implementing GHG emission reductions.

Climate change is a complex natural disaster problem that requires the cooperation of all parties involved in the process of handling it. (Zeppel, 2011). This has encouraged the Bojonegoro Regency Government to commit to implementing action steps to mitigate climate change. Climate change mitigation is a process or effort to reduce the risk of increased greenhouse gas emissions. Prioritising a collaborative approach is expected to increase the effectiveness and efficiency of handling it, given that the government has limited resources, functions, and roles. (Dapilah et al., 2021).

Implementing climate change mitigation in Bojonegoro District uses a collaborative approach using the Penta helix model. According to Awaluddin et al. (2016), in pentahelix collaboration, there are five main components, namely: 1) government, 2) business, 3) academia, 4) community and 5) media. Several parties are involved in implementing climate change mitigation action steps in Bojonegoro Regency. The involvement of these stakeholders uses the Penta helix concept according to Awaluddin et al. (2016)(2016), namely government (Bojonegoro District Environmental Agency), business (PT Asri Dharma Sejahtera), community or civil society organisations (Ademos Indonesia), academics (Bojonegoro University), and media (Suara Banyuurip). Through this collaboration, the contribution of each actor will be seen in carrying out its role to support and succeed in the program to be implemented.

Each stakeholder involved has their duties and functions. Sudiana et al. (2020) argue that the stakeholders who play a role have their respective functions to contribute to the implementation of collaboration. The government acts as a facilitator, executor, and regulator who has authority in the political and legal fields so that it can contribute by granting permits and policies, providing incentives and grants, and providing infrastructure that supports innovation development. The business sector supports the knowledge-based economy and encourages innovation through the provision of capital, networks, and cooperation. Academics who have been equipped with knowledge can contribute to developing human resources (HR), conducting research, and identifying potential. The community, in this case, plays a role in bridging communication between stakeholders and forming an interaction forum for the birth of creative ideas. At the same time, the media, in this case, also plays a role in providing objective and accurate information to the public in order to build good communication between parties. The cooperation between these parties is expected to overcome the weaknesses of sectoral and top-down approaches that often occur and tend to ignore aspects of program sustainability in the long term.

Previous research conducted by Rita Wati et al.showed that the implementation of collaboration was effective in increasing community participation and had a positive impact on reducing the effects of disasters. In addition, previous research by Denok (2017) showed that the collaborative institutional model can strengthen networks and information and minimise misunderstandings between stakeholders. This model can also clarify the roles and functions of each stakeholder. With this, researchers are interested in examining the collaboration process in climate change mitigation in Bojonegoro Regency to find out the roles and functions of each pentahelix stakeholder.

This research offers novelty in the climate change mitigation approach by adopting an integrative approach involving various pentahelix stakeholders. With the formulation of the research question "How are the Roles and Contributions of Pentahelix Stakeholders in Collaborating as an Effort to Mitigate Climate Change in Bojonegoro Regency?" this research will discuss in detail the roles and contributions between stakeholders in mitigating climate change in Bojonegoro Regency. The results of this research are expected to make a positive contribution to improving the effectiveness and efficiency of climate change adaptation and mitigation, as well as strengthening cooperation among stakeholders in environmental management and protection in the future. In addition, this research is expected to provide concrete guidance for the Bojonegoro District Government and other stakeholders in designing and implementing climate change mitigation policies that are more effective, inclusive, and oriented towards better environmental management.

2. METHOD

This research is qualitative research with a case study approach. This research aims to describe the role and contribution of pentahelix stakeholders in the implementation of climate change mitigation in Bojonegoro Regency. The case study approach is a research method that makes it possible to examine phenomena in social life and individual problems based on the overall depiction of the word order and the delivery of opinions from informants combined in a scientific work (Creswell JW, 2012). (Creswell JW, 2012).

Sources of data and information are obtained by researchers through data collection techniques by means of interviews, namely the process of interaction through questions and answers between researchers and informants or research subjects to explore the information needed. There are two types of interviews, namely in-depth interviews and directed interviews. (Rahardjo Mudjia, 2011). Data were also obtained through observation, which is an activity of observing by going directly to the research location to see the actual conditions and activities carried out by informants at the research location. Furthermore, documentation, where information is not only obtained by researchers through interviews and observations but information is also obtained through documentation in the form of letters, photo archives, written policy statements, legal regulation books, as well as the results of research journals or articles on pentahelix collaboration which can then be used as references. (Septiana et al., 2021).

Researchers used purposive sampling techniques to determine informants. According to Yusuf (2014: 369) (Septian, 2021), purposive sampling is a technique for selecting informants selectively based on consideration of research objectives and the need for the information needed, not randomly. The informants chosen by the researcher are those who have contributed and supported the implementation of climate change mitigation in Bojonegoro Regency, namely the Environmental Control Division of the Bojonegoro Regency Environmental Agency, the Chairperson of Ademos Indonesia, Lecturer in Environmental Science at the University of Bojonegoro, President Director of PT Asri Dharma Sejahtera, and Managing Editor of Suara Banyuurip Media.

From the data obtained by researchers, data processing is then carried out using the data analysis method according to Miles & Huberman (1994), which suggests that the data analysis process starts with reducing data, presenting data, and verifying, which then ends with concluding. For data validity, triangulation techniques were used, according to Sugiyono (2013), where the data collection technique is done by combining data from various existing sources.

3. RESULTS AND DISCUSSION

In implementing climate change mitigation in Bojonegoro Regency, five Penta helix elements are involved, namely ABCGM (Academics, Business, Community, Government, and Media). Stakeholders work together to achieve common goals. The contribution of these stakeholders can be seen from the roles performed based on their respective main tasks and functions. The following author describes the contribution of each stakeholder in the implementation of climate change mitigation in Bojonegoro Regency:

Figure 2. Pentahelix Model in Climate Change Mitigation in Bojonegoro District

Source: Processed by researchers

Government as Policy Driver & Coordination

The Bojonegoro Regency Environmental Service is a Regional Apparatus Organization (OPD) that carries out government affairs in the environmental sector. The functions and duties are set out in Bojonegoro Regent Regulation Number 87 of 2021 concerning the Position, Organizational Structure, Job Description and Functions and Work Procedures of the Bojonegoro Regency Environmental Service. Referring to this regulation, DLH, as the leading sector, has the responsibility to provide adequate facilities and infrastructure to support the success of mitigation, develop policies and regulations related to climate change mitigation, conduct socialisation and education on the importance of implementing mitigation against climate change, and facilitate collaboration between stakeholders. The role of the government in formulating policies and regulations will affect the success of mitigation to be implemented.

> *"Because the current strategic issue is climate change, starting from international, Indonesian, to down in local governments now continue to encourage mitigation, because the impact is now very real, so the issue of climate change is currently our tagline, our priority program so that much budget is budgeted for efforts to mitigate climate change, dlh programs now also focus on handling and reducing GHG emissions, so our budget is mostly used for that."* (said Nur Rahmawati, Head of Environmental Control)

Based on this statement, DLH's commitment to climate change mitigation is currently demonstrated by the launch of "Bojonegoro Cares for Carbon Emissions", which aims to control the impact of climate change by reducing Greenhouse Gas emissions (GHG). In encouraging participation from the community

to take action to adapt and mitigate climate change by reducing carbon emissions and increasing public understanding of carbon emissions and climate change, simultaneously, the Bojonegoro District Government through DLH, in collaboration with PT Asri Dharma Sejahtera held the "Adibuana Carbon Award" which involved the participation of 430 villages from 28 sub-districts, and 30 of them were awarded because they were able to absorb the most emissions. This activity received appreciation from the Ministry of Environment and Forestry because it was considered effective in encouraging community groups to take action to adapt and mitigate climate change by reducing carbon emissions. In addition, this activity also provides appreciation in the form of incentives to selected villages, which is considered to strengthen their resilience and commitment to dealing with the impacts of climate change. In addition, this activity promotes the adoption of a low-emission lifestyle among the community.

Figure 3. Bojonegoro's declaration of Carbon Emission Awareness
Source: dlh.bojonegorokab.go.id

Figure 4. Adibuana Carbon Award
Source: Suara Merdeka Jogja

In addition, DLH Bojonegoro Regency also encourages waste management with Maggot BSF cultivation. Unlike other flies, Maggot BSF can decompose organic waste well, so it does not cause odour and can reduce air pollution. DLH also provides socialisation to the community regarding this matter so that the community can become agents of change and prevent environmental damage caused by pollution. Based on data recorded from organic waste managed by Maggot BSF from December 2022 to January 2023, the total waste managed was 30kg from 15 grams of maggot. Of course, if this can be done continuously, it can be of economic value and effective in reducing methane gas emissions generated from organic waste and animal faeces**.**

In 2023, DLH Bojonegoro also designed a GHG Inventory document, which is an effort by the Bojonegoro District Government to calculate the sources of GHG emissions and to know the level, status, and trend of changes in GHG emissions on a regular basis from various sectors. By knowing this information, the Bojonegoro District Government can manage GHG emissions properly, mitigate emissions in a planned manner, and support national GHG emissions management. So, in this case, the government, especially DLH, is the primary driver in the implementation of climate change mitigation in Bojonegoro Regency.

Community as Democracy Strengthening & Community Empowerment

Civil Society Organizations (CSOs) play an essential role in the implementation of climate change mitigation by advocating and monitoring environmental policies. They serve as a bridge between the community and the government and encourage public participation in decision-making. However, from the results of interviews obtained by researchers, the government, as the leading sector in implementing climate

change mitigation, has yet to involve CSO to the fullest. CSO involvement is only limited to the planning stage.

> *"As for involvement, we CSOs have not reached that stage. The involvement of CSO is only at the planning stage; even then, it is only ceremonies such as tree planting, limited to attendance and formality, at the next stage of implementation and monitoring, and others we have not been involved in. Still, maybe the government also has limitations to involve"* (said Arsyad, Chairman of Ademos Indonesia).

> *"However, we, Ademos, as CSO, are also trying to participate in mitigating climate change at the school level; here we are the initiator, we educate on the importance of mitigation, how to do the right mitigation, we explain what emissions are, where they come from, then we encourage mitigation by planting trees,"* (added Arsyad).

Based on this statement, as a civil society organisation, Ademos Indonesia itself seeks to contribute to climate change mitigation in Bojonegoro Regency. In this case, Ademos contributes to mitigating climate change by implementing tree planting and reducing carbon emission footprints at the school level. Ademos, in collaboration with PT Pertamina EP Cepu, carried out 1000 tree planting activities or named the creation of school forests in 3 schools, namely SMPN 1 Ngasem, SMPN 1 Ngambon, and SMPN 2 Purwosari. In this program, carbon emissions generated from activities in the school are calculated. A fee committee is formed to redeem the emissions generated from the school activities so that the redemption is known to be suitable plants for the absorption of carbon emissions generated. Of course, this can increase understanding and educate students in the school about the importance of mitigating climate change.

Business as Partnership & Funding

The implementation of climate change mitigation must be distinct from the role of the private or business sector. Close collaboration between stakeholders is the primary key to supporting the implementation of effective and inclusive climate change mitigation. The role of the business sector is to provide financial and technical support in the form of investment and partnerships. Furthermore, the private sector also has a vital role in empowering communities. Through training and mentoring, the private sector helps improve the quality of human resources by providing insight into the importance of climate change mitigation.

PT Asri Dharma Sejahtera is the BUMD of Bojonegoro Regency that manages the Blok Cepu Participating Interest and is committed to supporting economic growth and regional development through investment and Corporate Social Responsibility (CSR) programs in various fields, one of which is the environment. In the Bojonegoro Care for Carbon Emissions program, which is demonstrated by concrete action through the implementation of the Adibuana Carbon Award, PT ADS contributes by fully facilitating the program, including socialisation and providing resources in the form of infrastructure and funding. This program is part of PT ADS's Corporate Social Responsibility, which is budgeted from the total value of more than Rp54 billion of PT ADS's Corporate Social Responsibility funds. Through CSR programs, one of which is the Adibuana Carbon Award, PT ADS won the Outstanding Corporate Social Responsibility award at the 7th CNN Indonesia Award with the nomination of the best program and innovation.

> *"In our CSR program, one of the focuses is the environment, so in response to the issue of climate change that is currently happening, we contribute and continue to work through our CSR program. Currently, we are concentrating on planting trees and protecting water sources," (said Kundori, President and Director of PT ADS).*

Based on this statement, in response to environmental issues, one of which is climate change, PT Asri Dharma Sejahtera's CSR programs now concentrate on tree planting and clean water supply. With this, PT ADS fully contributes to the implementation of climate change mitigation in Bojonegoro Regency.

Academics as Research & Innovation Implementers

Academics have an essential role in implementing climate change mitigation. Equipped with knowledge, academics can contribute by conducting research and development so that they can provide scientifically based climate change mitigation policy recommendations. In the implementation of the Adibuana Carbon Award, Bojonegoro University, especially experts from the Environmental Science department, was involved in designing the concept of implementing the program.

> *"The issue of climate change should be about balancing the carbon balance; if we only focus on sequestration or uptake without any efforts to reduce emissions, it can be said to be ineffective" (said Laily, Lecturer in Environmental Science).*
> *"The Adibuana Carbon Award only assesses the conditions at that time; there is no effort to increase it, not necessarily the condition of vegetation in 2023 that is reported can offset the amount of our current emissions, so it is not optimal; it needs to be studied again," he added.*

Based on this statement, Unigoro thinks that the Adibuana Carbon Award program is actually good to implement because it can increase public understanding of carbon emissions. However, the implementation of the Adibuana Carbon Award still needs to be sustainable because the program only assesses existing conditions and conditions at the time of the program. In contrast, efforts to increase vegetation cover have yet to be made. The reported vegetation conditions in 2023 cannot offset the amount of emissions we produce today.

Unigoro was also asked to be an expert by PT Pertamina EP Cepu Zone 12 to map the position of 25,000 trembesi trees. Trembesi trees were chosen because they are known to produce oxygen from photosynthesis while absorbing carbon dioxide. It also serves as a shade tree during the summer. Unigoro was also involved in the EIA assessment, with three experts from Unigoro in construction, environment, and chemistry. Unigoro itself is also making efforts to mitigate climate change by educating students on the importance of climate change mitigation, committing to throwing garbage in its place and promoting tree planting.

> *"The type of plants chosen by the district government is not correct, for example, replacing the main tree with tabebuya, which has less absorption, only thinking about aesthetics, the selection of trees is not right, why not local plants whose absorption is more optimal, such as tamarind banyan which has many small leaves that have good absorption" (said Lecturer in Environmental Science).*

Based on this statement, Unigoro is currently aggressively conducting studies related to the selection of effective plants to increase carbon sequestration. One of them is by participating in environmental conservation efforts and developing argoforestation through the creation of an arboretum. In this case, Unigoro hopes that the government can formulate better policies on forest conservation and green open space, optimise plant uptake, and focus on reducing emission sources by balancing the carbon balance.

> *"In Bojonegoro Regency, the weakness is in data access; each agency sometimes cannot provide the data we need to develop the district, the openness of the data is lacking, trust in private campuses is also lacking, many studies are rushed to outside campuses, even though we are capable"* (said Lecturer *in* Environmental Science).

Based on the interview statement obtained by the researcher, academics, especially Unigoro, are still minimally involved, and access to data from the government to develop research conducted by Unigoro still needs to be improved. This is considered because trust in private universities still needs to be improved, and in each sector, there is still a structural ego; this is undoubtedly one of the obstacles in the implementation of climate change mitigation in Bojonegoro Regency.

Media as a Source of Information & Shaper of Public Opinion

Mass media in its various forms, whether print, electronic or online, is vital as an information bridge that connects multiple parties, both internal and external. Through vigorous reporting and publication, the media can help disseminate information related to programs, especially in the implementation of climate change mitigation. Suara Banyuurip, one of the media mecca for oil and gas and mining news, has a significant role in climate change mitigation in Bojonegoro Regency.

> *"Yes, we often report on climate change issues; there are many programs from the government, one of which is the Adibuana Carbon Aaward, Bojonegoro Cares about Carbon Emissions and many more besides that CSR Oil and Gas about climate change is also actively reported, so far we are updated,"* (said Dwi Suko, Managing Editor of Suara Banyuurip Media).

This media serves as a trusted source of information about the oil and gas industry, especially in Bojonegoro Regency. With a focus on current news, they provide the public with a better understanding of the activities carried out by oil and gas companies, including exploration, production, possible environmental impacts and Corporate Social Responsibility (CSR) activities in an effort to mitigate climate change. Suara Banyuurip media also covers the programs of the Bojonegoro Regency Government, one of which is "Bojonegoro Cares for Carbon Emissions". They actively convey information about the importance of environmental preservation, especially in climate change mitigation, in order to educate the public on how to take appropriate actions to reduce carbon footprints.

In this case, the role of the media is not only limited to reporting; they also take part in educating the public about climate change mitigation through their reporting. The media helps the public to be equally informed, thus enabling the public to make intelligent and responsible decisions. In addition, the media also has the power to mobilise support and shape public opinion to influence processes that occur in policy-making institutions. The active involvement of the press can undoubtedly contribute to the success of climate change mitigation efforts in the Bojonegoro District.

4. CONCLUSION

Based on the description of the results of the analysis, it can be concluded that the implementation of climate change mitigation in Bojonegoro Regency has been running quite well; stakeholders in the Penta helix play their role by contributing according to their respective duties and functions. However, when referring to the involvement of stakeholders in the collaboration process, relationships and coordination between stakeholders still need to be improved. The implementation of collaboration in climate change mitigation in Bojonegoro Regency is also considered to still have sectoral egos or silo mentality between stakeholders involved, who tend not to want to share information with other stakeholders. This is an obstacle and challenge in the implementation of climate change mitigation in Bojonegoro District, which can lead to separation between sectors or work units, which in turn can hamper the efficiency and effectiveness of its implementation. In this study, researchers only assessed the role and contribution of pentahelix stakeholders in collaborative climate change mitigation efforts, so further research needs to be

developed on other indicators or dimensions that have yet to be studied. Researchers also hope that there will be additional research with different research methods, a broader sample, and the use of other and more complete research instruments.

5. SUGGESTIONS

In implementing collaborative climate change mitigation efforts in Bojonegoro District, it is essential to build inclusive and transparent communication between various stakeholders. In addition, there is a need for incentive policies that encourage cooperation between sectors, such as recognition of the contribution of each party in mitigation implementation. Strengthening collaborative networks and focusing on shared goals can reduce sectoral egos and increase the effectiveness of the collaboration process.

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