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Reducing Greenhouse Gas Emissions through Community-based Action: an Analysis of the Program Kampung Iklim in Indonesia

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Abstract

One strategy to deal with climate change is accelerating greenhouse gas (GHG) emissions reduction through a community-based approach. In Indonesia, the government pursues community engagement to reduce GHG emissions through the Program Kampung Iklim (ProKlim). This study aims to determine community-based action to manage sustainable resources in the waste, livestock, agriculture, energy, and forestry sectors. Furthermore, this study measures how much CBA contributes to national GHG emission reductions. The study mainly used a literature review method. *Data was collected from 2015-2018, then measured emission reductions (ER) in the waste, livestock, agriculture, energy, and forestry sectors by subtracting baseline and mitigation emissions. The analysis compares the emission reductions achieved through Community-based Action (CBA) to the national emission reduction achievement. The results show that the sector with the most participation rates and the most significant contributor to emission reductions in ProKlim is the energy and waste sector. On the other hand, the sectors that attract the least public attention and emission reduction are the livestock and agriculture sectors. Through 61 community groups and 138 actions, from 2015 to 2018, CBA contributed 133,312.38 tons of CO2e emission reductions, 0.012% to national emission reductions, with the participation value equivalent to USD$266.080. Based on this number, CBA can be the answer to Indonesia's low position in international carbon trading. A strategy that focuses on increasing community participation is needed to optimize the contribution of the CBA to large-scale national emission reductions.*

Keywords: *climate change, community-based action, greenhouse gas emission, program kampung iklim*

Introduction

Climate change refers to long-term changes that affect the conditions and patterns of extreme weather events. It started with increased carbon dioxide in the air, Earth's temperature, melting Arctic Sea ice, and rising sea levels (NASA, 2022). In the process, climate change can multiply health threats, environmental crises such as droughts, floods, and depletion of the ozone layer (Kakaki, 2013). This issue impacts the balance of the ecosystem, especially biodiversity. Higher earth temperatures make some horticultural commodities unable to adapt, making farmers suffer crop failure (Rollin, et al., 2022). Not only threatening land commodities, but climate change also affects fishery commodities,

threatening coastal communities' resilience (Novianti, Warsilah, & Wahyono, 2016). If not addressed immediately, it will threaten global food security. Climate change is also closely related to human infectious diseases such as cholera and malaria (Anwar, et al., 2019) and animal and plant diseases (Amare, 2018). This disease becomes a threat because the life of the pathogen is getting longer, the host defense system is getting weaker, and the environment is increasingly supporting the transmission of viruses and bacteria (Wu, Lu, Zhou, Chen, & Xu, 2016). Besides ecological disasters, climate change also affects local community welfare (Sunito, Shohibuddin, & Soetarto, 2019), and other social problems, such as prostitution in coastal areas (Irfani, 2021). At a certain point, climate change makes vulnerable communities more vulnerable both socially, economically, and environmentally (Fatkhullah, Habib, & Nisa, 2022).

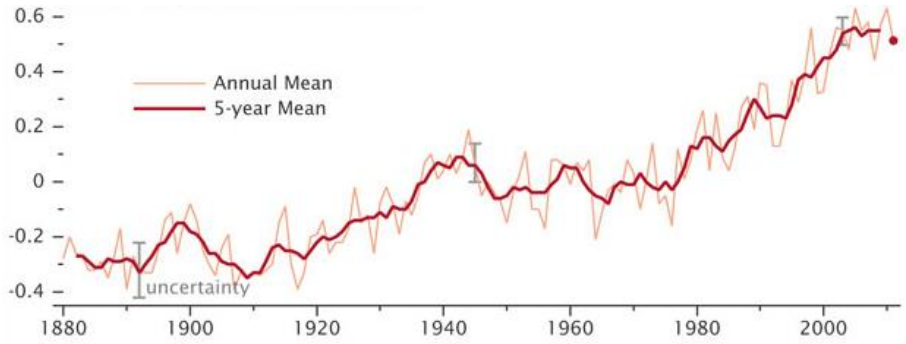

Figure 1. Global Temperature Difference (ºC), (McCarthy, 2011)

The global average surface temperature in 2011 was the ninth warmest since 1880, as shown in figure 1. This finding continues a trend in which nine of the ten warmest years in the modern meteorological record have occurred since 2000. This phenomenon results from increasing concentrations of greenhouse gases in the atmosphere, particularly carbon dioxide. These gases absorb the infrared radiation emitted by Earth and release that energy into the atmosphere instead of releasing it into space. As the concentration of the atmosphere increases, the amount of energy "trapped" by these gases causes the temperature to be higher. Although volcanic eruptions, continental plate movements, and several natural events can be triggers, industrialization is the leading cause of our environmental crisis (Hegerl, et al., 2019). Reducing GHG emissions is an essential agenda in dealing with climate change, requiring contributions from every country.

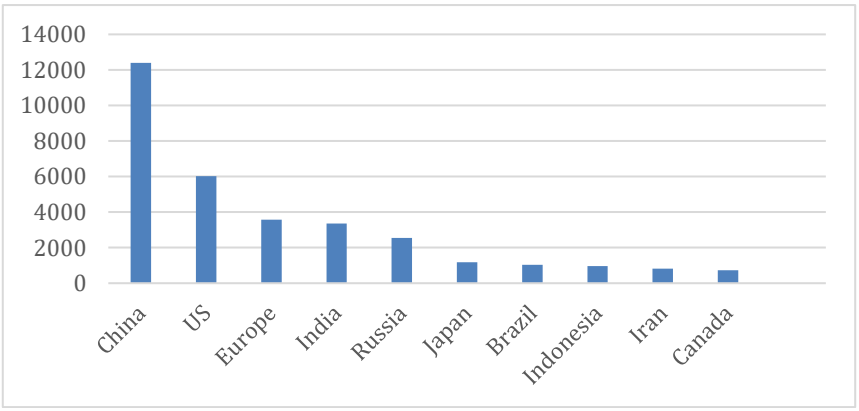

Figure 2. The Largest Greenhouse Gas Emission Contributors (Friedrich, Ge, & Pickens, 2020)

The World Research Institute (WRI) reveals that more than half of global greenhouse gas emissions come from ten countries. Figure 2 shows that in 2018, China was the most significant contributor to greenhouse gas emissions (Pusparisa, 2021). The three largest emitters of greenhouse gases, including China, the European Union, and the United States, accounted for 41.5 percent of global emissions. In contrast, the 100 lowest emitting countries only accounted for 3.6 percent of global emissions. The ten largest emitting countries collectively produce more than two-thirds of global GHG emissions. This comparison indicates that the world's efforts in dealing with climate change will not succeed without the significant role of the ten largest emitting countries, including Indonesia.

Policies that focus on preserving biodiversity are proven to make the food industry more sustainable (Wu, Lu, Zhou, Chen, & Xu, 2016). On the other hand, Latin America, Asia, Africa, and Oceania have recently implemented many land-based technologies in reforestation, bioenergy, biochar, and soil carbon sequestration to address climate change Oseania (Jaschke & Biermann, 2022). Policy

design processes that involve cross-sectoral integration at regional, national, and global levels have proven effective in various countries in avoiding the consequences of global climate change by leveraging potential synergies in the areas of health, equity, and the environment (Fears, et al., 2021). However, is the same policy relevant for developing countries like Indonesia?

The Government of Indonesia has announced low carbon development in its Medium-Term Development Plan (MTDP) for 2020-2024 to achieve 29% of the national emission reduction target through independent action and 41% with international support by 2030 (Fiscal Policy Agency, 2020). Climate change management in Indonesia generally focuses on the energy, Industrial Process and Product Uses (IPPU), waste, agriculture, plantation, forestry, and land use sectors (Directorate of Greenhouse Gas Inventory and Monitoring, Reporting and Verification, 2021).

One strategy to deal with climate change is to reduce GHG emissions through a community-based approach. Community-based action refers to a participatory approach in which individuals within a community come together to identify and address issues that affect their collective well-being (Skrip, et al., 2020). It involves the active involvement of community members, organizations, and stakeholders in decision-making processes, problem-solving, and taking actions to bring about positive change (Ernst & Riemsdijk, 2013). Community-based action is closely linked to community empowerment, as it aims to enhance the capacity of individuals and communities to influence and control their own lives and circumstances (Heritage & Dooris, 2009). Community-based action promotes active participation and engagement of community members, empowering them to voice concerns and contribute their knowledge and skills in shaping decisions that affect their lives. It encourages collaboration and networking among community members, organizations, and stakeholders, fostering collective problem-solving and a stronger sense of community cohesion. This approach also provides opportunities for knowledge and skill development, enabling individuals to take on leadership roles and become agents of change within their communities. Through collective action and mobilization, community-based action empowers communities to address common issues, set shared goals, and work towards sustainable solutions. By focusing on addressing root causes and empowering communities to take charge of their own development, it aims to achieve long-term, meaningful, and sustainable change.

Through community-based action, communities gain a sense of ownership and responsibility for addressing their challenges and improving their overall conditions (Yates, Stein, & Wyman, 2010). This approach has been widely used in tourism to increase visits and promote more equitable and sustainable management. This approach is also considered effective in developing students' academic skills, personalities, and responsibility in the education sector (Ibrahim, 2010). Other studies in the health sector reveal improved outcomes for communities in obtaining health services and access through this approach (Nickel & Knesebeck, 2020). In other words, this approach is very applicable to community development, especially in overcoming climate change. After all, the community is one of the parties responsible for increasing GHG emissions. Therefore, this approach answers the Indonesian government's target to reduce GHG emissions by 29% by 2030.

Table 1. National GHG Emission Conditions

	2015	2016	2017	2018
BAU (Milion ton CO2e)	1,702.37	1,768.91	1,820.49	1,862.96
ER CM1 (Milion ton CO2e)	1,359.00	1,375.00	1,394.00	1,418.00
Inventory (Milion ton CO2e)	2,343.37	1,335.52	1,353.85	1,615.57

Source: DGGIMRV (2021, p. 131)

In 2015, the GHG emission inventory in Indonesia was 2,343.37 million tons of CO2e as we can see in table 1. Meanwhile, GHG emissions based on business as usual (BAU) in the same year were 1,702.37 million tons of CO2e. In other words, Indonesia still has a 641 million tons of CO2e GHG emissions surplus, which should have been reduced by 343.37 million tons of CO2e in the same year. In 2016, the Indonesian government was able to reduce emissions by 433.39 million tons of CO2e, 10.02% higher than the emission reduction target for that year. This achievement continued in 2017 when the Indonesian government was able to reduce GHG emissions by 466.64 million tons of CO2e, 9.41% higher than the emission reduction target for that year. Although the Indonesian government has been quite consistent in reducing GHG emissions for the last three years, in 2018, the emission reduction was only able to reach 55.60% of the targeted amount. The Indonesian government pursues community engagement to reduce GHG emissions through the Program Kampung Iklim (ProKlim). ProKlim is a national-scale program managed by the Ministry of Environment and Forestry (MEF), which aims to increase community participation and other stakeholders to adapt and mitigate the impacts of climate change and reduce greenhouse gas emissions.

Through this program, the Indonesian government also appreciates the community and other stakeholders participating in climate change adaptation and mitigation. As for the determination of the

ProKlim area, the lowest is at the community unit or hamlet level, and the highest is at the sub-district or village level (Directorate General of Climate Change, 2017, p. 9). Indonesian government designed ProKlim in 2011 and has been implementing it since 2012. To date, ProKlim is the only government program that makes an inventory of community-based actions, including climate change adaptation and mitigation actions.

This study aims to determine community-based action to manage sustainable resources in the waste, livestock, agriculture, energy, and forestry sectors through ProKlim from 2015 to 2018. Furthermore, this study measures how much CBA contributes to national GHG emission reductions. This study is interesting because, until now, developing countries such as Indonesia still have a relatively subordinate role in reducing GHG emissions and dealing with climate change compared to developed countries (Aldy, Barrett, & Stavins, 2003). The intervention of the local government to be actively involved in overcoming climate change has proven to affect the image of a country (Schill, Godefroit-Winkel, & Hughes, 2020). Therefore, at the end of this paper, the author shows how CBA can be a promising solution for Indonesia to become a significant player in saving the environment, especially climate change, through competitive advantages in carbon trading.

Methodology

This study mainly used a literature review method to measure community participation in ProKlim and its contribution to national GHG emission reductions. We collected data from secondary sources such as roadmaps, government regulations, and annual reports related to the implementation of ProKlim. Community participation is mapped based on the report on the implementation of the Program Kampung Iklim from 2016-2018. Meanwhile, the same year's emission reductions in the waste, livestock, agriculture, energy, and forestry sectors were calculated based on its statistical reports. Community-based actions were then classified based on the type, sector, and amount of emissions released.

The reduction of GHG emissions in waste treatment through community-based actions is measured by determining the baseline emission first. The baseline used is the activity baseline, the emission released on ongoing activities. Domestic solid waste baseline emission is calculated based on the Intergovernmental Panel on Climate Change (IPCC) Guidelines (2006). After the baseline emission is determined, the next step is to calculate the amount of emission after the action has been taken. So that the potential for emission reduction through CBA can be calculated. In other words, the calculation of GHG emission reduction is generally calculated by the following formula:

$$\text{Emission reduction} = \text{Baseline emission} - \text{Mitigation emission} \quad (1)$$

Climate change adaptation and mitigation actions in the livestock and agriculture sectors aim to reduce CO2, N2O and CH4 released into the atmosphere. The method used to calculate the reduction of GHG emissions from CBA in the livestock and agriculture sector is still consistent with the IPCC (2006). However, the baseline determination is based on preventable carbon release into the atmosphere and absorbed into the environment. This method also applies to the energy sector. On the other hand, the calculation of GHG emission reductions in the energy sector includes emissions from burning fossil fuels such as fuel oil, liquefied petroleum gas (LPG), and coal briquettes. In addition, using renewable energy to replace fossil-based energy is also one of the indicators in this sector, because they offer a sustainable and environmentally friendly solution for electricity generation, reducing greenhouse gas emissions and mitigating the impacts of climate change (Mulyani, Fatkhullah, & Imawan, 2023). Renewable energy includes solar energy, wind energy, hydro energy, and the utilization of methane gas from waste.

We measure GHG emission reductions in the sector based on actions to prevent the loss of carbon stores and actions to increase carbon sequestration. The actions to prevent the loss of carbon storage include community forest management with secondary forest cover or mixed secondary forest. The method to calculate "the carbon stock of tree biomass above ground level" uses an allometric model (Chave, et al., 2005) with the following formula:

$$AGB = \rho \times \exp(-1{,}499 + 2{,}148 \ln(D) + 0{,}207(\ln(D))2 - 0{,}0281(\ln(D))3) \quad (2)$$

AGB is the aboveground biomass of individual trees, D = diameter at breast height (DBH), while ρ = wood density determined based on The Functional Attributes and Ecological Database (n.d.). The measurement of GHG emissions for actions to increase carbon stocks is calculated based on the absorption of carbon emissions from the growth of planted trees. The planting area has been adjusted to the success rate of planting following the Biennial Update Report (2015), with the following formula:

Absorption = Planted Area x Growth (Land Cover Increase) (3)

Emission reductions through CBA are then compared to the reductions achieved nationally, based on Business as Usual (BAU) emissions that have been subtracted by emissions inventoried from 2015 to 2018. The CBA's contribution to national emission reductions is then calculated. Meanwhile, the value of community participation is measured based on Indonesian Law (UU) no. 7 (2021) concerning the Harmonization of Taxation Regulations (HPP), which regulates the carbon tax.

Results

ProKlim is a national-scale community-based action motivated by impacts of climate change that increase future economic, social, and environmental risks. ProKlim applies the concept of community empowerment (Community Based Development), where existing activities are supported by the government so that the community can rise; gain power, strength, and independence in making decisions and determining strategies to solve various problems (Fatkhullah, Mulyani, Dewi, Habib, & Reihan, 2021). Through ProKlim, the government mobilizes human resources to manage natural resources in a sustainable way to strengthen efforts to adapt and mitigate the impacts of climate change (Directorate General of Climate Change, 2017, p. 12). An understanding of increasing surface temperatures, increasing vulnerability, and the potential and projected future impacts of climate change is basic knowledge that is educated to the community. So that through ProKlim, the community can play an active role (take action) in adapting and mitigating to increase resilience and avoid destructive impacts due to climate change.

Table 2. Community-based Action (2015-2018)

Actions	**Total**	**%**
Forest and land fire prevention	1	2.1%
Forest & mangrove afforestation	4	8.5%
Partial carbon stock addition	9	19.1%
Unused yard optimization	1	2.1%
Implementing a sustainable irrigation system	2	4.2%
Processing and utilizing organic fertilizers	7	15.0%
Waste bank development	7	15.0%
Takakura development	3	6.3%
Processing and utilizing biogas	9	19.1%
Agricultural land rehabilitation	4	8.5%
Total	47	100%

Source: Processed and adapted from DGCC (2019, pp. 49-56)

Although the scope of action in ProKlim is very diverse, in practice, from 2015 to 2018, the actions that are inventoried, as we can see in table 2, are still very limited. These actions are all only about: reducing fires in agricultural activities, reforestation, mangrove rehabilitation, increasing partial carbon stocks, utilizing unused yards, utilizing organic fertilizers, developing sustainable irrigation systems, waste banks, takakura, biogas, and agricultural land rehabilitation. On the other hand, community participation in ProKlim in 2015-2018 is still relatively low.

Table 3. Community Participation in Climate Change Adaptation and Mitigation

Sector	**2015**	**2016**	**2017**	**2018**	**Total**
Waste	2	0	17	14	33
Livestock	0	2	9	5	16
Agriculture	0	1	7	13	21
Energy	2	2	20	14	38
Forestry	0	3	8	19	30
Total	4	8	61	65	138

Source: Processed and adapted from DGCC (2019, pp. 49-56)

In 2015 there were only two community groups that registered for ProKlim. The most significant increase in community participation in ProKlim occurred in 2017, from three community groups to twenty-eight community groups. The same thing happened in the aspect of activities, which not only increased in number but also became more varied in type. In 2015, only four community actions were registered in ProKlim. This number then doubled in 2018 and increased significantly in 2017 to 61 actions. The sector with the most public participation was the energy sector with 38 actions and followed by the waste sector with 33 actions. In 2018, the agriculture and forestry sectors began to gain interest

from the community. The two sectors are also sectors that consistently experience an increase in the number of actions from year to year. Unfortunately, the emission reductions in these two sectors are not as large as in the Waste and Energy sector. On the other hand, the sector that has the least interest from the community from year to year is the Livestock sector, with 16 actions.

Table 4. Emission Reduction Based on Sector through Community Based Action

Sector	2015	2016	2017	2018	Total	Average
Waste	3.23	0.00	648.93	56,853.02	57,505.18	14,376.30
Livestock	0.00	0.93	287.84	642.54	931.31	232.83
Agriculture	0.00	8.20	199.96	25.69	233.85	58.46
Energy	85.02	64.49	1,280.53	62,247.06	63,677.10	15,919.28
Forestry	0.00	1,469.63	2,716.82	6,778.48	10,964.93	2,741.23
Total	88.25	1,543.25	5,134.08	126,546.79	133,312.38	33,328.09

Source: Processed and adapted from DGCC (2019, pp. 49-56)

Based on table 4, the sector with the most emission reductions in recent years is the energy sector with 15,919.28 tons of CO2e average ER per year, followed by the waste sector with 14,376.30 tons of CO2e average ER per year. This achievement was obtained from the high participation and variety of community actions in each sector. On the other hand, the sectors that consistently achieve an increase in emission reductions are the forestry sector with 2,741.23 tons CO2e average emission reduction per year and the livestock sector with 232.83 tons CO2e average emission reduction per year. Meanwhile, the sector that reduces the least emissions is the agricultural sector, with 58.46 tons of CO2e average emission reduction per year. Overall, from 2015 to 2018, CBA reduced GHG emissions by 133312.38 tons of CO2e, with 33328.09 tons of CO2e average emission reductions per year.

Table 5. Community-Based Action Contribution to National GHG Emission Reduction (ER)

	2015	2016	2017	2018
BAU (Milion ton CO2e)	1,702.37	1,768.91	1,820.49	1,862.96
ER CM1 (Milion ton CO2e)	1,359.00	1,375.00	1,394.00	1,418.00
Inventory (Milion ton CO2e)	2,343.37	1,335.52	1,353.85	1,615.57
National ER Target (Milion ton CO2e)	343.37	393.91	426.49	444.96
National ER Achieved (Juta ton CO2e)	-641.00	433.39	466.64	247.39
NERA to NERT (%)	-186.68	110.02	109.41	55.60
CBA ER (ton CO2e)	88.25	1,543.25	5,134.08	126,546.79
CBA ER to NERA (%)	-	0.00036%	0.0011%	0.051%

Source: Processed and adapted from DGCC (2019, pp. 49-56); DGGIMRV (2021, p. 131)

The community takes part in reducing national GHG emissions. Through ProKlim, we can see CBA's contribution to national GHG in table 5. In 2015, the Indonesian government failed to achieve its GHG emission reduction target, and CBA's contribution to national emission reduction is inconclusive. CBA reduced 1,543.25 tons of CO2e GHG emissions in 2016, so the contribution to the national GHG emission reduction was 0.000356%. This number increased in 2017, along with the increase in participation from previously only eight community groups to 28 community groups. Approximately 5,134.08 tons of CO2e emission were reduced through CBA, contributing by 0.0011% to the national GHG emission reduction. In 2018, CBA's contribution increased, in line with the increase of community action varieties. Approximately 126,546.79 tons of CO2e can be reduced through 65 actions, contributing by 0.051% to the national emission reductions in the same year. Through 61 community groups and 138 actions, from 2015 to 2018, CBA contributed to 133,312.38 tons of CO2e emission reductions, with a USD$266.080 participation value. Meanwhile, from 2016 to 2018, CBA contributed 0.012% to national emission reductions.

Discussion

The low percentage of CBA's contribution to national GHG emissions reduction is due to the low participation of the community and local government in ProKlim. Some regions or community groups tend to be inconsistent or show low interest in participating in this program. In fact, the actions they take to support climate change adaptation and mitigation may still run consistently. Although the CBA's contribution to national GHG emission reductions is less significant, it does not mean that the CBA does not have an impact at all. Based on Indonesian Law no. 7 (2021) which regulates the carbon tax in Indonesia, the equivalent value of carbon dioxide (CO2e) per kilogram (kg) is IDR30. As we know that emission reduction through CBA is 133,312.38 tonnes of CO2e; based on the July 9th exchange rate, the value of community-based action is equivalent to USD$176 in 2015, USD$3,091 in 2016,

USD$9,329 in 2017, and USD$253,483 in 2018. The total value of the CBA from 2015-2018 is equivalent to USD$266.080. In this context, community-based action to reduce greenhouse gas emissions through ProKlim can be the answer to Indonesia's low position in international carbon trading (Prijadikusuma, 2012). This can be realized by the Indonesian government by increasing community participation.

Since the inventory of community-base action GHG emission reductions began in 2015, while data for 2019 and beyond are still not reported, further studies over a longer period are needed to obtain a clearer relationship between community participation and greenhouse gas emission reduction. If community participation can be projected, and there is a target that increases every year, based on the size of the population and its territory, Indonesia will become a country that has a major contribution to environmental sustainability on a global scale.

Another aspect apart from the program implementation mechanism, which is no less important to consider, is how the policy or program is delivered. A more comprehensive process in educating, socializing the program, and disseminating information related to ProKlim is needed. However, this process should not be carried out in a one-way method. The Ministry of Environment and Forestry needs to review how the information that has been disseminated regarding ProKlim is received by the community, especially on technical procedures that require more attention. This is essential in assessing the understanding of the community and local government towards ProKlim, both at the conceptual and technical levels, and can be the basis for developing additional strategies to increase awareness, knowledge, and community participation. It is possible that the low participation of the community and government in ProKlim is due to the low level of understanding of the community and local government, which is exacerbated by the high level of complexity in CBA reporting.

In general, ProKlim is delivered as a persuasive appeal, using a reward system by providing incentives to community groups and local governments who have a high level of participation and good performance in this program. In the process, the ProKlim assessment then became a competition between local governments. In fact, the implementation of this system can motivate community groups and local governments. However, in practice, the dissemination of information related to ProKlim among local governments becomes full of conflicts of interests (Habib, Fatkhullah, Mukaromah, & Budita, 2022). On the other hand, the incentives provided are very prone to bias. Reward-oriented participation has implications for fraud, which can reduce the validity of the national data that have been inventoried. Apart from these issues, the MEF could also consider penalizing local governments that underperform or have low participation rates in ProKlim, as holding companies in the United States, Europe, Japan, and Canada penalize foreign affiliates that are less efficient at emissions management (Jiang, López, Cadarso, & Ortiz, 2022). This can be started by setting a minimum target for ProKlim participation in each region and gradually increasing the target both in quantity and quality.

It is important to involve other government agencies, both within and outside the ministry, as well as the private sector, to achieve transparency. The involvement is expected not only to be ceremonial in nature, as in socialization and information dissemination events but to be carried out through integration at the policy level to implementation. Collaboration is carried out, for example, with the Job Training Center, the Fisheries Service, or the Community and Village Empowerment Service to provide assistance to well perform community groups in reducing GHG emissions. Assistance is provided to achieve efficiency and increase revenue through sustainable business practices. That way, ProKlim has its own economic value that makes other communities interested in participating (Habib, Nisa, Fatkhullah, Ursah, & Budita, 2022). This can be realized by utilizing one government agency's budget, combining the budgets of two or more government agencies, or diverting the budget that should be allocated for incentives. That way, the involvement of various stakeholders is not always about the willingness to promote ProKlim. Moreover, multisectoral involvement places ProKlim as a joint program, where the success of the program is a shared achievement and vice versa. In other words, ProKlim is not only from and for the Ministry of Environment and Forestry but also all components in the government, private sector, and citizens.

Conclusion and Suggestions

Conclusion

ProKlim mobilizes human resources to be able to manage natural resources in a sustainable way in order to strengthen efforts to adapt and mitigate the impacts of climate change. From 2015 to 2018, community-based actions included: fire prevention in agricultural activities, reforestation and mangrove rehabilitation, partial carbon stock enhancement, utilization of unused yards, processing and utilization of organic fertilizers, implementation of sustainable irrigation systems, development of waste banks, takakura, biogas, and rehabilitation of agricultural land.

The sector with the most participation rates and the biggest contributor to emission reductions in ProKlim is the energy sector with 38 actions and the waste sector with 33 actions. Meanwhile, the sectors that consistently experienced an increase in the number of actions were the agriculture and forestry sectors. The sector with the most emission reductions in recent years is the energy sector with 15,919.28 tons of CO2e average ER per year, followed by the waste sector with 14,376.30 tons of CO2e average ER per year. The amount of emission reduction through CBA is determined by the participation rates and the number of community actions. On the other hand, the sectors that consistently achieve an increase in emission reductions are the forestry sector with 2,741.23 tons CO2e average emission reduction per year and the livestock sector with 232.83 tons CO2e average emission reduction per year. Meanwhile, the sector that reduces the least emissions is the agricultural sector, with 58.46 tons of CO2e average emission reduction per year. Through 61 community groups and 138 actions, from 2015 to 2018, CBA contributed to 133,312.38 tons of CO2e emission reductions, 0.012% to national emission reductions, with a participation value equivalent to USD$266.080. Community-based action can be the answer to Indonesia's low position in international carbon trading. This can be realized if the Indonesian government can increase community participation in ProKlim.

Suggestions

Although the participation rate tends to increase compared to the area and population, the participation rate of the community and local government still needs to reach expectations. This can be started by setting a minimum target for ProKlim participation in each region and gradually increasing the target in quantity and quality. On the other hand, the Ministry of Environment and Forestry could also consider penalizing local governments that underperform or have low participation rates in ProKlim. In addition to providing guidance and appreciation to communities that contribute to reducing greenhouse gas emissions, the Ministry of Environment and Forestry could also consider penalizing local governments that underperform or have low participation rates in ProKlim. On the other hand, the Ministry of Environment and Forestry must strive for climate-friendly technology that is accessible to the public. To increase community participation in reducing greenhouse gas emissions, the government must develop programs involving more NGOs and the private sector. This involvement is carried out through integration at the policy, planning, implementation, evaluation, and reporting level. Through this engagement strategy, stakeholders can play a role in campaigning for ProKlim to the broader community. On the other hand, they also benefit from the process, so they voluntarily oversee the success of this program with their own strategies.

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