

Enhancing Collaborative Governance for Sustainable Water Resource Management Regulations: Challenges and Opportunities in the Context of SDGs

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Abstract

Sustainable water resource management is a critical factor in the successful attainment of the Sustainable Development Goals (SDGs). The multifaceted challenges inherent in water resource management, such as scarcity, pollution, and climate change, call for a collaborative governance model that incorporates the perspectives and participation of various stakeholders. This research aims to delve into the challenges and opportunities present in strengthening collaborative governance mechanisms for sustainable water resource management regulations, with the ultimate goal of identifying strategies to enhance their efficacy. Adopting a normative approach, this study will explore the theoretical underpinnings of collaborative governance, critically assess the current regulatory framework governing water management in Indonesia, and investigate the intricate relationship between collaborative governance practices and the achievement of water-related SDG targets. Through a comprehensive analysis of these factors, this research seeks to generate valuable insights that can inform the development of effective policies and strategies aimed at fostering sustainable and equitable water resource management practices in Indonesia. The anticipated outcomes of this research hold significant potential to contribute to the broader discourse on sustainable water resource management, offering practical recommendations for policymakers, practitioners, and other stakeholders engaged in the pursuit of water security and environmental sustainability.

Keywords: collaborative governance, sustainable water resource management, regulations, SDGs.

1. Introduction

Water is source Power essential nature for life And livelihood all over creatures on earth . Its continued availability become crucial , especially in face challenge growth population , rapid urbanization , and change climate . Unfortunately , the management of source water resources in Indonesia are still face various challenge complex , start from degradation water quality , pollution , to conflict utilization [1] . Report latest from Ministry Environment Life And Forestry (KLHK) in 2023 shows that more from half rivers in 34 provinces in Indonesia are polluted . Although happen A little repair with decline amount polluted river heavy amounting to 46% of the total 70,000 rivers , the condition This still worrying And show existence problem Serious in management river water quality in Indonesia [2] .

Inequality access towards clean water become problem seriously , where Lots society , especially in the regions rural And isolated , difficulties get clean water For fulfil need base they . This is impact on health , sanitation , and productivity society [3] . On the other hand others , water utilization in the sector agriculture And industry often Not yet efficient , causing waste And reduce availability of water for need other .

The problem management source this water power the more complicated with existence fragmentation authority between agency And sector . Weak coordination between stakeholders interest

cause overlap overlap policy And management source water power that is not integrated . Condition This aggravated by limitations capacity And participation public in taking decision related management source water power [4] .

By Because that , is needed a approach holistic And collaborative in management source water resources in Indonesia. Approach This must capable overcome various existing challenges And ensure sustainable water availability for all over layer society , good moment This or in the future upcoming . Challenges the show urgency implementation management source integrated sustainable water power And collaborative .

Sustainable Development Goals (SDGs), in particular Objective 6, sets targets to " ensure availability And clean water management And sustainable sanitation For all " on in 2030 [4] . However , achieving SDG 6 is not can realized only by One parties . Complexity water problems demand synergy And collaboration between various stakeholders interests , including government , private , community civil , and Academics . Governance collaborative become key in integrate various perspective , knowledge , and source Power For formulate And implement policy management source effective , fair and equitable water resources sustainable .

Although promising , implementation order manage collaborative No off from various challenge . Start from gap capacity , lack of trust between stakeholders interests , up to conflict interests . By Because that , is needed deep understanding about challenge And opportunity in increase order manage collaborative For regulation management source sustainable water power in SDGs context .

Study This aiming For to study implementation order manage collaborative in management source sustainable water resources in Indonesia. In general specific , research This will : (1) identify challenges faced in implementation order manage collaborative , (2) analyzing opportunities that can utilized For increase effectiveness order manage collaborative , especially in context achievement Sustainable Development Goals (SDGs), and (3) formulating strategy comprehensive For overcome challenge And utilise opportunity the use realize management source sustainable water resources And fair .

With answer questions said , research This expected can give recommendation for for taker policy And stakeholders related in increase effectiveness regulation management source water power and contribute on achievement of SDGs, especially SDG 6, in Indonesia.

2. Method

Study This use method normative For to study order manage collaborative in management source sustainable water power [5] . Steps First is collection material primary law , which includes Constitution 1945 Constitution , Law Number 7 of 2004 concerning Source Water Power , Regulation Government Number 42 of 2008 concerning Management Source Water Power , as well as regulation other relevant legislation . In addition that , also collected materials law secondary like books , journals , articles scientific , document policies , and report relevant research with Topic study .

Stage furthermore is analysis material the law that has been collected . Analysis This includes content analysis for identify principles , norms , and rule relevant laws with order manage collaborative in management source water power . Then , a comparative analysis was carried out with compare regulation legislation in Indonesia with practice good in other countries . Results analysis This will interpreted And synthesized For answer formulation problem study And formulate conclusion as well as recommendation .

Method study normative chosen Because in accordance with objective research , namely to study framework law And policy , analyzing implementation order manage collaborative , and formulate recommendation its improvement in SDGs context . For ensure reliability And validity research , conducted data triangulation , definition clear operational , use technique systematic data analysis And transparent , as well as a comprehensive literature review . With Thus , it is expected study This can

produce valid findings and contribute on development knowledge knowledge And policies in the field of management source sustainable water power .

3. Results and Discussion

2.1. Challenge in Implementing Governance Collaborative

2.1.1. *Conflict of interest between stakeholders.*

Collaborative governance in water resources management involves diverse stakeholders with diverse interests. This diversity of interests, although potentially enriching perspectives and solutions, is also a potential source of conflict that can hinder management effectiveness [6] . Conflicts of interest can arise in various forms, including:

a. Conflict of use :

Water, an essential source of life, is being fought over amidst increasing human needs. The agricultural sector, with its large water needs for irrigation, often clashes with industry which also requires water in its production process. Conflict is inevitable when the available water resources are insufficient to meet the needs of both sectors. Competition is increasingly complex with the inclusion of household needs for clean water and the need for hydroelectric power plants [7] . Each sector feels that its interests are the most vital, thus creating tension and complicating efforts to manage water resources fairly and sustainably.

This condition is exacerbated by climate change which causes erratic rainfall patterns and increased frequency of droughts. On the other hand, pollution of rivers and other water sources further reduces the availability of clean water. The challenge ahead is to find a balance between meeting the needs of various sectors with the increasingly limited availability of water. Wise policies, technological innovation to increase the efficiency of water use, and awareness of all parties to maintain the sustainability of water resources are needed.

b. Allocation conflict:

Limited water availability is a crucial issue in various parts of the world, especially in areas with minimal rainfall or high population density. Competition for increasingly dwindling water resources triggers conflict and tension between various parties, including individuals, groups, and countries.

Water conflicts are often triggered by fundamental questions about water access rights and allocation. Who deserves more water? Which sectors should be prioritized, agriculture, industry, or households? How can a fair and equitable water distribution system be implemented? These questions are the critical points that are prone to causing disputes.

The situation is exacerbated by climate change, which is causing increasingly erratic weather patterns, worsening droughts in some areas, and threatening the availability of clean water. This uncertainty increases pressure on already limited water resources, making water conflicts even more vulnerable.

Therefore, it is important to develop sustainable and equitable water management strategies. An integrated approach involving all stakeholders, as well as the application of innovative technologies to improve water use efficiency, are key to preventing and resolving water conflicts.

c. Conflict of authority :

Overlapping authority between government agencies, both central and regional, is a classic problem that hampers the effectiveness of water resources management in Indonesia. This condition creates ambiguity in the division of tasks and responsibilities, so that coordination between agencies becomes difficult and decision-making is hampered [8] . As a result, water resources management programs often do not run optimally, even neglected.

The ambiguity of rules and boundaries of authority between agencies has the potential to cause conflicts of interest and sectoral egos. Each agency tends to maintain its authority, so

that cooperation and synergy in water resource management are weak. This situation is exacerbated by the lack of communication and coordination between agencies, which ultimately leads to inefficiency in the use of budgets and resources.

The impact of this overlapping authority is not only felt at the level of program planning and implementation, but also at the level of supervision. Weak coordination makes it difficult to supervise the use of water resources, making it prone to misuse and environmental damage. To overcome this problem, it is necessary to rearrange the authority between government agencies that is clear and firm. The government needs to formulate comprehensive and integrated regulations and strengthen the coordination and supervision system. In addition, increasing the capacity of human resources in each agency also needs to be done so that they are able to carry out their duties and functions professionally.

d. Conflict of values and perceptions :

Conflicts in water resource management often arise due to differences in values, norms, and perceptions among stakeholders. Indigenous communities, for example, often have different views from the government or private companies regarding how water should be managed and utilized. Local wisdom that they have practiced for generations, which emphasizes sustainability and harmony with nature, can clash with economic and development interests promoted by other parties [8] .

Differences in perceptions regarding access rights and fairness in water management also trigger conflict. For indigenous peoples, water is a source of life that must be protected and utilized together fairly. Meanwhile, the government or private sector may see water as an economic commodity that can be exploited for certain interests. The imbalance of power between the stakeholders further exacerbates the conflict, where indigenous peoples are often in a weak position in fighting for their rights.

This conflict can manifest in various forms, from debates and protests to legal disputes. The impacts are quite significant, ranging from environmental damage, hampered development, to prolonged social conflict. Therefore, it is important for all parties to prioritize dialogue and deliberation to find fair and sustainable solutions in water resource management.

Recognition of indigenous peoples' rights, respect for local wisdom, and enforcement of the principles of justice and environmental sustainability must be the basis for every policy and action related to water resources management. Only then can conflicts be prevented and water resources be utilized optimally for the welfare of the entire community.

3.1.2 Capacity imbalance between stakeholders.

Capacity imbalances among stakeholders are one of the crucial challenges in implementing collaborative governance for sustainable water resources management. These imbalances can cover various aspects, such as:

a. Knowledge and information gap:

Inequality of access to information and knowledge about water resources is a serious challenge in its management. Unequal distribution of information among stakeholders creates a gap in understanding and ability to manage water resources sustainably [9] . For example, upstream communities, despite having deep local knowledge about water sources, often have limited access to the latest scientific and technological information. These limitations can hinder their efforts to optimize the use of water resources and maintain their sustainability.

On the other hand, government or private actors, who generally have better access to information, sometimes have less understanding of local social and ecological conditions. This can result in water resource management policies or programs that are not in accordance with the needs and characteristics of the area. This inconsistency can lead to conflicts of interest, environmental damage, and even program failure.

Therefore, it is important to create a water resources information system that is inclusive and easily accessible to all stakeholders. This system must be able to bridge the information gap between local communities, government, and the private sector. Thus, each party can contribute optimally to sustainable water resources management, based on a comprehensive and complementary understanding.

The development of an integrated information platform that provides the latest data and information on water resources, laws and regulations, technology, and best practices is one solution that needs to be considered. This platform must be designed by considering the needs and characteristics of users from various backgrounds, so that information can be easily accessed and understood by all stakeholders.

b. Disparity in technical and managerial capabilities:

The imbalance of technical and managerial capabilities between stakeholders in water resources management often occurs. Local communities, for example, often have deep traditional knowledge of water resources in their area. However, they may be less exposed to modern approaches to sustainable water planning, organizing, and management. On the other hand, governments or private companies generally have access to more advanced technology and technical expertise.

This condition can create an unequal dynamic, where local communities feel marginalized in the decision-making process regarding water resources in their own areas. In fact, active participation of local communities is very important to ensure sustainability and fairness in water resource management.

To address this inequality, efforts are needed to increase the capacity of local communities. Training programs, mentoring, and knowledge transfer need to be designed and implemented inclusively, taking into account local wisdom and the specific needs of the community. The government and private sector also need to open up equal dialogue and collaboration with local communities, so that water resource management can provide equitable benefits for all parties.

c. Inequality of financial resources:

Access to financial resources plays a crucial role in determining stakeholders' ability to contribute to water resources management. The availability of funds is a determining factor in implementing various initiatives, from conservation, infrastructure development, to public education [10].

Poor or marginalized communities often face challenges in allocating funds for activities related to water resources. Economic constraints make them prioritize basic needs such as food and shelter, making it difficult to invest in water resource conservation or development efforts. In fact, these groups are often the most vulnerable to the negative impacts of poor water resource management, such as drought or flooding.

On the other hand, government and private actors generally have greater access to financial resources. The government is obliged to allocate public funds for water resource management, while the private sector can utilize investment capital for water-related projects. However, access to financial resources alone is not enough. Commitment and good governance are needed to ensure that funds are used effectively and efficiently for the sustainability of water resources.

This gap in access to financial resources can create imbalances in water resource management. Therefore, it is important to create mechanisms that allow all stakeholders, including the poor and marginalized, to participate in water resource management. This can be done through various instruments, such as subsidies, community empowerment programs, and microfinance schemes that facilitate access to capital.

d. Inequality of political power and influence:

The imbalance of political power creates a dynamic in which the voices and interests of different groups in society are not heard equally. Stakeholders with greater influence, such as political elites or dominant economic groups, have access and resources that allow them to dominate the decision-making process [11] .

On the other hand, marginalized groups, such as the poor, minorities, or those living in remote areas, often face systemic barriers that limit their participation. Lack of access to information, education, and social capital makes it difficult for them to articulate their interests and influence public policy.

This inequality can have serious implications for social and economic justice. The resulting policies tend to be biased towards the interests of powerful groups, while the needs and aspirations of marginalized groups are neglected. This can worsen social inequality, hinder inclusive development, and trigger social conflict.

To address this inequality, steps are needed to strengthen the political participation of marginalized groups. Increasing access to education, information, and economic resources can empower them to actively engage in the political process. Institutional reforms that ensure transparency and accountability in decision-making are also essential to ensure that all voices are heard and considered.

3.1.3 Lack of trust and communication between stakeholders.

Trust and effective communication are important foundations in building successful collaborative governance [12] . Unfortunately, in practice, the lack of trust and adequate communication often becomes a stumbling block in realizing optimal collaboration, especially in water resources management.

a. Trust Deficit:

Trust is indeed an important foundation in building solid cooperation and reaching mutual agreements, especially in water resource management that involves various interests. However, this trust is fragile and can be eroded by various factors. One of the most influential factors is negative experiences in the past [13] . A history of conflict, injustice, or neglect of certain rights in water resource management can leave deep wounds and foster a sense of distrust between stakeholders. This past trauma can be a major obstacle in building harmonious cooperation.

In addition, lack of transparency and non-transparency are also significant factors that erode trust. When stakeholders are reluctant to share their data, information, and interests openly, this will trigger suspicion and doubt among them. Unclear information can create prejudice and hinder the achievement of understanding. Transparency is key to building mutual trust and ensuring that each party feels heard and their interests are respected.

Differences in perception and values also pose challenges in building trust between stakeholders. Each stakeholder has different views and values regarding water resources, their use priorities, and the concept of justice. These differences can lead to misunderstandings, debates, and even conflicts. It is important for stakeholders to understand and respect each other's perspectives, and to find common ground to reach a fair and sustainable agreement.

Another factor that can erode trust is poor communication. Lack of effective communication between stakeholders can lead to miscommunication, misunderstandings, and even conflict. Information that is not conveyed properly, or misinterpreted, can raise suspicion and damage relationships between stakeholders. Therefore, it is important to build open, honest, and effective communication to create mutual understanding and trust.

Inconsistency in actions and behavior can also damage trust. When stakeholders fail to keep promises, break agreements, or act contrary to their word, this destroys their credibility and

reduces the trust of other stakeholders. Consistency between words and actions is an important element in building and maintaining long-term trust.

b. Communication Barriers:

Effective communication plays a crucial role in bridging differences, preventing misunderstandings, and building consensus among stakeholders. Think of stakeholders as an orchestra; each member has a unique role and voice that needs to be harmonized to create a beautiful symphony. Smooth communication acts as a conductor that brings all the elements together, ensuring that every voice is heard and understood [14].

However, sometimes there is "noise" or interference that hinders this harmony. One of them is unequal access to information. When some stakeholders have more access to important information than others, an imbalance of power is created that can trigger distrust and conflict. Marginalized stakeholders will find it difficult to actively participate and voice their interests, making the decision-making process less inclusive and representative.

The inability to communicate is also a significant barrier. Differences in language, culture, and educational background can lead to misinterpretation and misunderstanding. The message conveyed may not be received with the same meaning by all parties, making it difficult to achieve common goals. Like two people speaking different languages, without a competent translator, productive dialogue will be difficult to achieve.

In addition, the absence of adequate forums and communication mechanisms is also an inhibiting factor. Without a forum that facilitates structured dialogue and information exchange, communication between stakeholders will tend to be sporadic, informal, and vulnerable to disinformation. An inclusive forum and transparent communication mechanisms will encourage active participation, facilitate the delivery of aspirations, and build a sense of shared ownership of the decisions taken.

In short, effective communication is an important foundation in building successful collaboration between stakeholders. Equal access to information, good communication skills, and the existence of adequate forums and communication mechanisms are the keys to creating synergy and achieving common goals.

3.1.4. Bureaucratic and institutional barriers

Collaborative governance, despite its potential, is often hampered by deep-rooted bureaucratic and institutional barriers. These barriers can reduce the effectiveness of collaboration between stakeholders and hinder the achievement of sustainable water resource management goals. Some common bureaucratic and institutional barriers include:

a. Rigid and convoluted bureaucratic structure:

Rigid and convoluted bureaucratic structures are one of the main challenges in effective and sustainable water resource management. Long, complicated, and inflexible bureaucratic processes can make it difficult for various parties, including the community, to actively participate.

For example, in terms of water utilization permits, complicated procedures and complex requirements often hinder community initiatives, especially farmer groups or communities who want to develop simple irrigation systems or conserve water in their environment. As a result, the potential for community participation in maintaining the sustainability of water resources is hampered.

In addition, a hierarchical and centralized bureaucratic structure can complicate coordination between agencies related to water resources management. Decision-making is often centralized at the top level, making it less responsive to conditions and needs at the ground level. This can hinder efforts to manage water resources in an integrated and sustainable manner, due to the lack of coordination and synchronization of programs between agencies.

This condition also makes it difficult to involve stakeholders in the decision-making process. In fact, community participation in water resource management is very important, because the community is the one who feels the most direct impact of the policies and programs implemented.

Therefore, bureaucratic reform in the water resources sector is very important. Simplifying procedures, increasing transparency, and decentralizing authority are key steps to create better water resources governance. With a more responsive and participatory bureaucracy, it is hoped that water resources management can be more optimal and sustainable.

b. Overlapping authority between agencies:

Overlapping authority between government agencies, both at the central and regional levels, is a classic problem that often hampers the effectiveness of water resource management in Indonesia. The unclear boundaries of authority of each agency often cause confusion and even conflict in the field. This condition is exacerbated by the existence of overlapping, multi-interpretible, and not yet fully synchronized laws and regulations.

As a result, coordination between agencies becomes difficult, programs become unintegrated, and decision-making related to water resource management becomes slow and inefficient. Duplication of activities, budget waste, and the potential for corruption are also increasing.

A real example of this overlapping authority can be seen in the management of River Basin Areas (DAS). The Ministry of Environment and Forestry (KLHK) has the authority in forest conservation in the upstream DAS, the Ministry of Public Works and Public Housing (PUPR) is responsible for irrigation infrastructure, while the Ministry of Agriculture focuses on irrigation for agriculture. When coordination is weak, the sectoral egos of each agency will emerge, so that programs that should support each other actually run independently and are not optimal. This situation is certainly detrimental to the community, especially those who depend on the availability of water. Conflicts over water use between sectors, such as between industry and agriculture, or between regions, for example between upstream and downstream, will occur more frequently. In the end, the goal of realizing sustainable and equitable water resource management will be difficult to achieve.

Therefore, serious efforts are needed to overcome this overlapping authority. Harmonization of laws and regulations, strengthening coordination between agencies, increasing institutional capacity, and strict law enforcement are the keys to success in realizing good water governance in Indonesia.

c. Lack of coordination and communication between agencies:

The lack of effective coordination and communication between government agencies is a serious obstacle to integrated and sustainable water resources management. Synergy and integration between agencies are disrupted when important information is not distributed well, consultation between related parties is minimal, and the sectoral ego of each agency is prioritized.

This condition can trigger various problems, such as overlapping authority and programs. For example, two different agencies implement a water infrastructure development program in the same area without coordination, resulting in budget waste and potential conflict in the field.

Another problem that arises is the misalignment of data and information. Data on water availability, water needs, and water resource potential that differs between agencies makes it difficult to make appropriate and accurate decisions.

Lack of coordination also causes slow response to problems. Drought or flood disasters often require rapid handling from various agencies. Poor coordination causes slow distribution of aid and unintegrated handling.

Low community participation is also an impact of the lack of coordination between agencies. Communities become confused when faced with many agencies responsible for water resources. This hinders their participation in water resource management in their area. Therefore, it is important for government agencies to improve coordination and communication in water resources management. Building a common platform to share data and information, holding regular discussion and consultation forums, and prioritizing common interests over sectoral egos are concrete steps that can be taken.

d. Weak institutional capacity:

Weak institutional capacity is a significant barrier to the effectiveness of collaborative water resource governance. At both government and civil society levels, this weakness can manifest itself in various forms, ranging from a lack of trained human resources to inadequate management systems. Budget constraints are also a limiting factor, as they can limit the ability of stakeholders to carry out their duties and responsibilities.

In the government sector, weak institutional capacity can be reflected in a complex and less responsive bureaucracy. This can hamper the decision-making process and implementation of policies related to water resources management. Lack of coordination between government agencies is also a common problem. As a result, overlapping or even conflicting programs and activities can occur, reducing the efficiency and effectiveness of water resources management. On the other hand, civil society also often faces challenges in terms of institutional capacity. Civil society organizations may have limitations in terms of human resources, technical skills, and access to information. This can make it difficult for them to participate effectively in decision-making processes and oversight of water resources management. In fact, active civil society participation is essential to ensure sustainability and equity in water resources management.

Strengthening institutional capacity is crucial to addressing this issue. The government needs to improve the quality of human resources, simplify bureaucracy, and improve coordination between agencies. On the other hand, empowering civil society through training, mentoring, and increasing access to information also needs to be done. By improving institutional capacity at all levels, more effective, efficient, and sustainable collaborative governance of water resources can be realized.

e. Lack of transparency and accountability:

Transparency and accountability are important pillars of good water resource governance. Unfortunately, the lack of transparency and accountability remains a challenge in the decision-making process and management of water resources in Indonesia. This can trigger distrust among stakeholders, create conflict, and hinder efforts to manage water resources sustainably. Lack of transparency in the decision-making process makes it difficult for communities to access important information, such as water allocation plans, water use permits, and water quality data. This condition creates uncertainty and doubt about the fairness and objectivity of the decisions taken. For example, communities living around water sources may not know how much water is allocated for industrial or agricultural needs, so they cannot be sure whether their water needs are being met fairly.

In addition, the lack of accountability in water resource management can lead to abuse of authority and corruption. Weak monitoring systems and lack of public participation facilitate detrimental practices, such as illegal water use, water pollution, and environmental destruction. As a result, water resources that should be used for the welfare of the people actually become objects of exploitation by irresponsible parties.

To improve transparency and accountability in water resources management, comprehensive efforts are needed from all parties. The government needs to increase the openness of public

information and actively involve the community in the decision-making process. In addition, the monitoring and law enforcement system needs to be strengthened to prevent and prosecute abuse of authority and corruption. Thus, it is hoped that water resources management can be carried out in a more fair, transparent and sustainable manner in order to realize the prosperity of the Indonesian people.

2.2. Opportunities to Enhance Collaborative Governance

3.2.1 Increasing public awareness and participation.

Increasing public awareness and participation is a crucial opportunity that needs to be utilized to improve the effectiveness of collaborative governance in water resources management. Active community involvement in decision-making and policy implementation processes has various benefits, including:

a. Local Knowledge and Traditional Wisdom:

Communities living side by side with water resources, such as rivers, lakes, or springs, have long developed hereditary knowledge and practices in managing water. This local wisdom is a valuable asset that contains a deep understanding of the water cycle, conservation, and sustainable use of water resources [3].

This local knowledge often takes the form of customary rules, rituals, or traditional management systems that have stood the test of time. For example, the subak system in Bali that regulates the distribution of irrigation water fairly and efficiently, or the tradition of planting trees around water sources to maintain water availability.

Combining local wisdom with modern scientific and technological knowledge can produce more effective and locally appropriate water resource management solutions. This approach not only respects ancestral wisdom but also empowers communities to play an active role in preserving water resources for future generations.

b. Monitoring and Supervision:

Communities play a crucial role in maintaining the sustainability of water resources through active monitoring and supervision. This public involvement creates an effective system of checks and balances for water resource management. Communities can directly monitor water use in their surroundings, ensuring that water is not wasted or used for irresponsible purposes.

Furthermore, the community also acts as the 'eyes and ears' for the authorities. When they find indications of pollution, illegal water use, or other violations of applicable regulations, the community can immediately report it to the relevant agencies. Reports from the community will greatly assist law enforcement efforts and prevent further damage to water resources.

With active community participation in monitoring and supervision, it is expected to create more transparent and accountable water resource governance. Openness of information and public involvement in decision-making will increase public trust in water resource management and ultimately encourage the realization of sustainable water resource use.

c. Caring and Sense of Responsibility:

Public participation in water resource management plays an important role in fostering public awareness and responsibility. When communities are actively involved in the decision-making process, planning, and implementation of water-related programs, they will feel they have a stake in preserving it.

This involvement raises awareness of the importance of water resources for life and encourages people to act responsibly. This sense of ownership and shared responsibility becomes a strong social capital in water conservation efforts, both on a small scale such as in the household environment and on a larger scale such as at the community level.

Public participation can also be an effective educational platform. Through discussion forums, workshops, or outreach activities, the public can gain deeper knowledge and understanding about the importance of maintaining water quality and quantity, as well as the negative impacts of unsustainable exploitation of water resources.

Thus, public participation not only raises awareness, but also empowers communities with the knowledge and skills needed to contribute significantly to water resource conservation.

d. *Increased Trust and Cooperation:*

Public involvement in water resources management plays a crucial role in building trust and solid cooperation between stakeholders. Through active community participation, a space for intensive dialogue and interaction is created, allowing various parties to exchange information, ideas, and perspectives. This process will gradually foster mutual trust and eliminate suspicion between stakeholders.

In discussion forums and deliberations, stakeholders can build a shared understanding of the various problems and challenges in water resource management. By actively involving the public, the resulting solutions tend to be more comprehensive and take into account the interests of all parties [15]. Openness and transparency in decision-making will also increase the accountability of water resource managers, thereby reducing the potential for conflict and distrust in the future.

Furthermore, increasing trust and cooperation between stakeholders will create conditions conducive to the implementation of sustainable water resources management. When all parties have the same vision and mission, it will be easier to coordinate various programs and activities, and allocate resources efficiently. Thus, public involvement not only increases trust and cooperation, but also makes a real contribution to efforts to preserve water resources for future generations.

3.2.2 *Utilization of information and communication technology.*

The rapid development of information and communication technology (ICT) opens up great opportunities to improve the effectiveness and efficiency of collaborative governance in water resources management. The use of ICT can help overcome various challenges and facilitate collaboration between stakeholders in the following ways:

a. *Improving accessibility of information:*

Increasing accessibility of information is crucial for effective water resources management. By utilizing information technology, such as online platforms, geographic information systems (GIS), and online databases, various stakeholders can obtain the latest data and information on water resources easily and quickly. This information can include rainfall data, water availability, water quality, and river basin (DAS) maps [16].

The availability of easily accessible and transparent information has a significant positive impact. Stakeholders, both government, private sector, and the general public, can understand the condition of water resources comprehensively. This will encourage more precise and data-based decision-making, both in planning, management, and utilization of water resources.

For example, farmers can access weather forecasts and water availability information to determine optimal planting times. Local governments can monitor water quality in real time and take swift action in the event of pollution. Thus, increasing accessibility to information contributes to sustainable and equitable water resource management.

b. *Facilitating communication and coordination:*

Information and Communication Technology (ICT) has brought about a revolutionary change in the way we communicate and coordinate, especially in the context of collaboration between various parties. In the past, communication was limited by distance and time, requiring physical meetings that were often inefficient. But now, ICT provides a variety of communication channels that enable more effective and flexible interactions.

Email, instant messaging, video conferencing, and online forums are tools that facilitate the exchange of information in real time, regardless of the geographic location of each stakeholder. Discussions, decision-making, and problem solving can be done together through these digital platforms. Imagine, meetings that used to require business travel and days of time, can now be completed in a matter of hours via video conference [16] .

The ability of ICT to facilitate communication and coordination has a significant impact on increasing efficiency and productivity. The decision-making process becomes faster, information is distributed evenly, and misunderstandings can be minimized. Thus, ICT is not just a communication tool, but also a catalyst in creating more effective and productive collaboration.

c. Encouraging public participation:

Information and Communication Technology (ICT) has great potential to encourage public participation in water resources management. By utilizing various digital platforms, such as online portals, mobile applications, and social media, the public can easily access information related to water resources, convey aspirations, file complaints, and provide suggestions to the authorities.

This ease of access and openness of information can increase transparency and accountability in water resource management. The community can play an active role in monitoring water use, reporting potential violations, and contributing to decision-making related to water resources.

This increase in public participation is expected to create a more democratic, fair and sustainable water resources management system. By involving all stakeholders, including the community, in the management process, it is expected to create a more comprehensive solution that suits the needs of all parties.

In addition, the use of ICT can also facilitate dialogue and collaboration between various stakeholders in water resource management. Online discussion forums, participatory mapping platforms, and integrated information systems can be a place for government, private sector, communities, and academics to share information, find joint solutions, and raise awareness of the importance of sustainable water resource management.

d. Supporting better decision making:

Information and Communication Technology (ICT) plays an important role in improving the quality of decision-making in various sectors. With its ability to process and analyze data quickly and accurately, ICT allows stakeholders to explore various policy alternatives more comprehensively.

The use of decision support systems and artificial intelligence (AI) further strengthens the role of ICT in the decision-making process [17] . AI, for example, can process complex data, recognize patterns, and provide more objective and measurable policy recommendations. This helps decision makers to minimize bias and consider various factors holistically before taking action.

In addition, ICT also facilitates the creation of simulation models and scenarios that allow stakeholders to project the impact of various policy options. Thus, ICT not only helps in identifying problems and formulating solutions, but also provides a clearer picture of the consequences of each decision taken.

The integration of ICT in the decision-making process ultimately aims to produce policies that are more effective, efficient and have a positive impact on society.

e. Improve management efficiency:

Information and Communication Technology (ICT) plays a crucial role in improving the efficiency of water resource infrastructure management. The implementation of ICT enables the optimization of the operation and maintenance of various infrastructures, such as dams, irrigation systems, and drinking water supplies.

The use of sensors, the Internet of Things (IoT), and automated control systems are real-world examples of how ICT can improve efficiency. Sensors installed on infrastructure can collect real-time data on water conditions, discharge, and potential leaks. This data is then processed and analyzed to optimize water use and detect leaks early.

Furthermore, the automated control system integrated with ICT enables more efficient and responsive water distribution arrangements to meet demand. By predicting future water needs based on historical data and environmental factors, ICT helps in making informed decisions to prevent water shortages or excesses.

The integration of ICT in water resources management not only increases efficiency, but also supports the sustainability and resilience of water infrastructure in the face of the challenges of climate change and population growth.

3.2.3 Multi-stakeholder partnership development.

The development of multi-stakeholder partnerships is an important opportunity to increase the effectiveness of collaborative governance of water resources management [18]. This partnership involves active collaboration between government, private sector, civil society, academics, and other stakeholders in planning, implementing, and monitoring water resources management.

Benefits of Multi-Stakeholder Partnerships:

- a. Combining the strengths and resources of various parties. The government has the authority in regulation and planning, the private sector has capital and innovation, civil society has local knowledge and social support, while academics provide scientific and technological studies.
- b. Increase trust and mutual understanding between stakeholders. Through intensive interaction and communication, stakeholders can understand each other's perspectives, interests, and constraints, thereby reducing the potential for conflict and increasing cooperation.
- c. Encouraging innovation and shared learning. Multi-stakeholder partnerships can create space for the exchange of knowledge, experiences and new ideas, thereby sparking innovation in water resources management.
- d. Increasing accountability and transparency. The involvement of various parties in decision-making and monitoring can increase accountability and transparency in water resources management.

3.2.4 Strengthening the legal and policy framework.

A strong and comprehensive legal and policy framework is an important foundation for the success of collaborative governance in water resources management. Strengthening this legal

and policy framework can create a conducive environment for collaboration between stakeholders, ensure legal certainty, and encourage sustainable water resources management [19].

Here are some opportunities to strengthen the legal and policy framework that can be utilized:

a. Harmonization of Legislation:

Reviewing and harmonizing existing laws and regulations is a crucial step to eliminate overlapping authorities, unclear rules, and potential conflicts between sectors in water resources management. This process aims to create a clear, integrated, and effective legal framework, thus facilitating the implementation of collaborative governance.

In addition, harmonization needs to ensure the alignment of all laws and regulations related to the principles of collaborative governance. Participation of various stakeholders, transparency in decision-making, accountability in implementation, and fairness in the use of water resources, must be reflected in the harmonized laws and regulations.

b. Strengthening the Role of Regional Government:

It is important to give greater authority to local governments in managing water resources in their respective regions. This will enable them to be more responsive to local needs and characteristics, and encourage innovation in water resource governance. Local governments need to be encouraged to develop local regulations that support collaborative governance, ensure active participation from various stakeholders, and adapt these regulations to the unique conditions of their regions.

In addition, increasing the capacity of local governments in planning, implementing, and supervising water resources management is also crucial. Training, mentoring, and provision of adequate resources will equip local governments with the ability to manage water resources effectively, efficiently, and sustainably. Thus, local governments can optimize the use of water resources to support regional development and realize sustainable development goals.

c. Integration of Water Resources Management with Other Sectors:

The development of an integrated policy framework is a crucial step in sustainable water resources management. This framework must be able to integrate water management with related sectors such as agriculture, forestry, energy, and spatial planning. This integration aims to create synergy between sectors, avoid conflicts of interest, and ensure that water utilization is carried out optimally and sustainably to support development in various fields.

In addition, inter-sectoral cooperation also needs to be encouraged, both in planning and management of water resources. This collaboration will facilitate coordination, avoid overlapping programs, and increase efficiency in the use of water resources. Thus, water availability can be maintained, environmental sustainability is guaranteed, and community welfare can be improved.

d. Development of Economic Instruments and Incentives:

The application of economic instruments, such as fair and efficient water tariffs, is crucial in encouraging sustainable use of water resources. Fair tariffs will reflect the true value of water and encourage efficient use, while efficient tariff-setting mechanisms will ensure the sustainability of water service delivery. This creates incentives for communities and industries to conserve water, reduce waste, and invest in water-saving technologies.

In addition, providing incentives to stakeholders who contribute to the conservation and preservation of water resources is also very important. These incentives can be in the form of financial support, awards, easy access to information and technology, and recognition of their efforts in preserving water resources. By providing appreciation and support, stakeholders will be increasingly motivated to play an active role in the conservation and preservation of water resources for future generations.

e. Improving Access to Information and Public Participation:

Transparency and public participation are two important pillars in sustainable water resource governance. Opening up access to information as widely as possible to the public regarding the condition of water resources, policies, and management programs will increase accountability and public trust in water resource management. With adequate information, the public can understand the condition of water resources, the challenges faced, and contribute to finding joint solutions.

In addition to transparency, developing effective public participation mechanisms is also crucial in planning, implementing, and monitoring water resources management. These mechanisms allow the public to convey their aspirations, provide input, and participate in decision-making. Inclusive and representative public participation will result in policies that are more responsive to community needs and sustainable in the long term.

f. Firm and Fair Law Enforcement:

Strict and fair law enforcement is key to preserving water resources. Any violations related to water use and pollution must be dealt with firmly without discrimination. An effective monitoring system also needs to be developed to prevent and handle violations of water resources laws and regulations.

By taking advantage of existing opportunities, strengthening the legal and policy framework can be a strategic step in increasing the effectiveness of collaborative governance. Strict law enforcement and an effective monitoring system will realize sustainable water resource management in Indonesia.

2.3. Strategies to Overcome Challenges and Take Advantage of Opportunities

2.3.1. Building an effective communication and coordination platform.

In facing challenges and taking advantage of opportunities in collaborative governance of water resources management, the establishment of an effective communication and coordination platform is crucial [20]. This platform acts as a forum for stakeholders to interact, exchange information, and build understanding in achieving common goals, namely sustainable water resources management.

Here are some key steps in building an effective communication and coordination platform:

a. Stakeholders Identification and Mapping:

An important first step is to identify and map all stakeholders involved in water resources management. This identification includes government actors at the central and regional levels, local communities, civil society organizations, the private sector, academics, and others. Stakeholder mapping helps in understanding the interests, roles, and influence of each actor.

b. Development of Accessible Communication Channels:

An effective communication platform must have communication channels that are accessible to all stakeholders. These communication channels can be face-to-face forums, online platforms, social media, and others. It is important to ensure that all stakeholders have equal access to information and can actively participate in communication.

c. Utilization of Information and Communication Technology:

Information and communication technologies (ICT) can be used to enhance the effectiveness of communication and coordination platforms. For example, geographic information systems (GIS) can be used to share spatial data and information about water resources. Online platforms can facilitate discussions, public consultations, and participatory decision-making.

d. Development of a Clear Coordination Mechanism:

The communication and coordination platform must have a clear and transparent coordination mechanism. This mechanism includes rules of the game, division of tasks and

responsibilities, and decision-making procedures. A good coordination mechanism will prevent overlapping authority and ensure that all stakeholders work together efficiently.

e. Strengthening Trust and Transparency:

Trust and transparency are essential foundations of collaborative governance. Communication and coordination platforms must be managed in a transparent and accountable manner. Information must be shared openly and easily accessible to all stakeholders. Decision-making processes must be inclusive and involve participation from all stakeholders.

2.3.2. *Improving stakeholder capacity.*

Increasing stakeholder capacity is a crucial foundation in realizing effective collaborative governance for sustainable water resources management [16]. This effort covers various aspects, including:

a. Knowledge and skills development:

Increasing the capacity of stakeholders in water resources management is crucial to achieving sustainability. Stakeholders need to be equipped with adequate knowledge and skills that cover various aspects. First, legal and policy aspects are important foundations. A comprehensive understanding of laws, policies, and legal instruments related to water resources management will ensure that every action is in accordance with applicable legal corridors.

Second, technical aspects are also no less important. Mastery of technical skills in planning, managing, and monitoring water resources, including the application of appropriate technology, will support the implementation of effective and efficient strategies. For example, an understanding of geographic information systems (GIS) can help in mapping and analyzing water resources.

In addition, social and environmental aspects need to be taken seriously. Awareness of the importance of social, economic, and environmental aspects in water resource management must be balanced with the ability to integrate these aspects in decision making. The ability to analyze the social and environmental impacts of each policy will avoid conflict and ensure sustainability.

Finally, the aspect of collaboration and communication is key in collaborative governance. The ability to communicate effectively, negotiate, and work together with other stakeholders is essential to reach agreements and realize common goals. By increasing the capacity of stakeholders in these various aspects, it is hoped that sustainable water resource management can be realized.

b. Institutional strengthening:

Institutional strengthening is a crucial factor in water resource governance. In addition to focusing on improving individual capacity, civil society organizations and local community groups need to be empowered to play an active role. This strengthening includes improving organizational capacity in various areas, such as planning, organizing, financial management, and administration. With a strong foundation, organizations can carry out their functions effectively and efficiently in water resource management.

Furthermore, the development of a democratic, transparent, and accountable organizational structure also needs to be prioritized. A good structure will encourage active participation of members, ensure fair and transparent decision-making, and realize accountability in water resource management. Institutional strengthening also needs to touch on improving advocacy and networking capabilities. Organizations that are able to voice community interests and build extensive networks will be more effective in influencing policies and accessing needed resources.

c. Increasing access to information and technology:

Equal access to information and technology is key to effective participation by all parties in water resource management. Imagine how people can help protect and utilize water resources if they do not know the current conditions, applicable regulations, or available technologies? Therefore, providing easy-to-understand and relevant information is crucial. This information must be available in various formats, both print and digital, to reach all groups.

In addition, it is necessary to build an integrated information system that is easily accessible to the public. This system will be a center for data and information related to water resources, from availability, quality, to utilization. Thus, transparency and accountability in water resource management can be improved.

Equally important is facilitating access to appropriate technology, especially for people in rural and remote areas. This technology can be in the form of water-saving devices, simple irrigation systems, or clean water treatment technology. With better access to technology, people can actively participate in sustainable water resource management.

d. Community empowerment:

Community empowerment is the main key to realizing collaborative and sustainable water resource management. The community is not just a beneficiary, but an important actor who needs to be actively involved in the entire management process. For this reason, increasing the capacity and empowering the community needs to be done through various efforts.

One way is to increase public awareness and participation. Awareness of the importance of preserving water resources must be fostered through education and dissemination of targeted information. In addition, communities need to be encouraged to actively participate in the planning, implementation, and supervision of water resource management in their areas. The development of local initiatives and local wisdom also needs to be empowered. Communities have valuable traditional knowledge and practices in managing water resources wisely. This local wisdom needs to be integrated with modern approaches to achieve optimal and sustainable management. In addition, strengthening the role of women and marginalized groups is also very important. Women and marginalized groups often have a high dependence on water resources, but their access and control are limited. Therefore, empowering women and marginalized groups will increase justice and equality in water resource management.

e. Partnership development:

Strong partnerships between stakeholders are the main foundation in realizing effective collaborative governance for sustainable water resources management. Solid collaboration allows for increased capacity and effectiveness in facing various challenges in water resources management. To realize strong partnerships, proactive efforts are needed in building constructive dialogue and cooperation between various related parties.

It is important for stakeholders to share information, perspectives, and expertise in an open and respectful atmosphere. Through intensive dialogue, misunderstandings can be minimized, trust can be built, and mutual agreements can be reached. Furthermore, partnerships can be strengthened through the establishment of multi-stakeholder forums that facilitate interaction, coordination, and joint decision-making.

This forum serves as a forum for communication and collaboration for all parties, from government, private sector, civil society, to academics. In addition, cooperation between sectors and regions also needs to be encouraged to avoid overlapping authorities and ensure integrated and sustainable water resource management.

By comprehensively enhancing stakeholder capacity, collaborative governance can become more inclusive, participatory, and effective in realizing sustainable water resources management and achieving SDGs goals.

2.3.3. *Promote transparency and accountability.*

Transparency and accountability are essential pillars of effective and equitable collaborative governance [21]. In the context of sustainable water resources management, these principles play a crucial role in building trust among stakeholders, encouraging public participation, and ensuring that decision-making is based on accurate information and comprehensive considerations.

a. Promoting Transparency:

Transparency in collaborative governance of water resources management is a crucial element that includes several important aspects. First, openness of information is key, where all stakeholders have the right to obtain easy and affordable access to related information, such as data on water availability, water quality, management plans, and budgets.

Second, openness of the decision-making process must also be prioritized. This process must be transparent and open to the public so that all stakeholders can understand the decision-making mechanism and provide constructive input. Finally, openness of the implementation of water resource management policies and programs must be guaranteed. Open and publicly monitored implementation will ensure accountability and prevent deviations.

b. Driving Accountability:

Encouraging accountability in collaborative governance of water resources management is crucial. Every stakeholder, especially the government, must be responsible for every decision and action taken related to water resources management. This accountability can be realized through several mechanisms, namely: provision of effective complaint and dispute resolution mechanisms, periodic evaluation and monitoring of water resources management performance, consistent law enforcement against violations, and public participation in monitoring water resources management.

c. Strategy to Increase Transparency and Accountability:

Increasing transparency and accountability in collaborative governance of water resources management can be achieved through various strategies. The use of information and communication technology (ICT) is key to disseminating information and facilitating public participation. This can be achieved by building an integrated and publicly accessible water resources information system, as well as developing a digital platform for public consultation and decision-making.

In addition, strengthening the role of independent supervisory institutions is also needed to ensure objectivity and balance. No less important is encouraging community and media empowerment in monitoring water resource management, so that an effective and participatory control mechanism is created.

d. Benefits of Transparency and Accountability:

Increasing transparency and accountability in collaborative governance of water resources management plays a crucial role in achieving sustainability. With transparency, the public can understand and monitor the decision-making process, thereby increasing trust in water resources management.

Accountability ensures that each party is responsible for its actions, encourages active participation from all stakeholders, and prevents the practice of corruption, collusion, and nepotism (KKN). The implementation of these two principles will increase the effectiveness and efficiency of water resources management, realize sustainable and equitable management, and support the achievement of sustainable development goals (SDGs).

2.3.4. Creating incentives for collaboration.

Incentives play a crucial role in encouraging collaboration between stakeholders in water resources management. The right incentives can motivate stakeholders to actively contribute, share knowledge, and work together to achieve common goals [22] . Here are some strategies for creating effective incentives:

a. Economic Incentives:

Subsidies and financial assistance: The government can provide subsidies or financial assistance to individuals, community groups, or organizations that contribute to the conservation and sustainable management of water resources. For example, subsidies for the construction of water-efficient irrigation systems, assistance for the development of rain harvesting technology, or micro-credit programs for water conservation efforts.

Tax and levy reductions: Fiscal incentives such as tax reductions or levies can be given to industries or companies that implement environmentally friendly and efficient technologies in water use.

Payment for environmental services: Payment for environmental services schemes can be implemented to provide compensation to upstream communities who play a role in preserving water resources.

b. Social Incentives:

Awards and recognition: Providing awards and public recognition to individuals, groups or organizations that make significant contributions to sustainable water resource management can increase motivation and pride.

Capacity building and access to information: Organizing training programs, workshops, and outreach to improve stakeholders' knowledge and skills in water resources management can be a valuable incentive.

Facilitating networking and partnerships: Facilitating the formation of networks and partnerships between stakeholders can increase cooperation, mutual learning, and synergy in water resources management.

c. Political and Legal Incentives:

Supportive policies and regulations: The government needs to create a policy and regulatory framework that supports collaborative governance, protects stakeholders' rights, and provides legal certainty in water resources management.

Involvement in decision-making: Providing space and mechanisms for stakeholders to actively participate in the decision-making process related to water resources management can increase their sense of ownership and responsibility.

Fair and consistent law enforcement: Enforcing the law fairly and consistently against violations in water resources management is important to create justice and prevent unsustainable exploitation of water resources.

2.3.5. Conduct regular monitoring and evaluation.

Systematic and regular monitoring and evaluation are crucial elements in enhancing the effectiveness of collaborative governance for sustainable water resources management [23] . This process enables stakeholders to measure progress, identify successes and failures, and make necessary adjustments to achieve shared goals.

Important Aspects in Monitoring and Evaluation:

a. Performance Indicator Development:

Formulate clear, measurable, achievable, relevant and time-bound (SMART) indicators to measure progress towards achieving sustainable water resources management goals. These indicators should cover social, economic and environmental aspects.

Data and Information Collection: Collect accurate and reliable data and information periodically through various methods, such as surveys, interviews, case studies, and remote sensing.

b. Data Analysis and Reporting:

Analyze the data and information that has been collected to identify trends, patterns, and factors that influence the success or failure of the program. The results of this analysis are then reported to all stakeholders in a transparent and accountable manner.

c. Performance Evaluation and Recommendations:

Conduct a critical evaluation of collaborative governance performance and identify opportunities for improvement. Based on the evaluation results, concrete recommendations are formulated that can be followed up by stakeholders.

d. Learning and Adaptation:

Utilizing monitoring and evaluation results as learning materials to improve the effectiveness of collaborative governance. Making adjustments to strategies, policies,

4 Conclusion

This study examines the challenges and opportunities in improving collaborative governance for sustainable water resource management regulations in Indonesia. The main focus of this study is to analyze how collaborative governance can be implemented effectively in the context of achieving the Sustainable Development Goals (SDGs), especially SDG 6 related to clean water and sanitation.

Several key challenges faced in implementing collaborative governance were identified in this study. These challenges include conflicts of interest among diverse stakeholders, capacity gaps among them, lack of trust and effective communication, and bureaucratic and institutional barriers that hinder collaboration.

Despite the challenges, the study also highlights opportunities that can be exploited to improve collaborative governance. These opportunities include increasing public awareness and participation in water resource management, utilizing information and communication technologies to improve coordination and access to information, developing multi-stakeholder partnerships, and strengthening legal and policy frameworks that support collaboration.

To overcome these challenges and take advantage of these opportunities, this study formulates a comprehensive strategy that needs to be implemented. These strategies include: (1) building an effective communication and coordination platform, (2) increasing stakeholder capacity, (3) encouraging transparency and accountability, (4) creating incentives for collaboration, and (5) conducting regular monitoring and evaluation.

By implementing these strategies, it is hoped that collaborative governance can be improved, so that water resource management regulations become more effective, fair, and sustainable. This improvement in collaborative governance will ultimately contribute to the achievement of SDGs in Indonesia, especially in ensuring the availability and sustainable management of clean water and sanitation for all Indonesian people.

5 Conflict of Interest

The authors declare that there are no conflicts of interest related to the authorship or publication of this article, entitled "Enhancing Collaborative Governance for Sustainable Water Resources Management Regulation: Challenges and Opportunities in the Context of the SDGs".

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