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ABSTRACT

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Water resources management is one of the crucial issues in people's lives, especially in areas where disasters often occur. Mount Merapi, as one of the active volcanoes in its area, is also a forest ecosystem in which the water source fulfills household, agriculture, and other basic needs; after the 2010 Merapi eruption, several springs were covered with eruptive material, destroying the water distribution pipeline. The post-eruption government policy was to reorganize the Merapi area and designate several areas (villages) to become Disaster-Prone Areas (Kawasan Rawan Bencana/KRB) and Directly Affected Areas (Area Terdampak Langsung). Establishing inter-village cooperation in water management at Merapi KRB is inseparable from this location's local wisdom and social institutions. Local wisdom and social institutions become the reinforcement and strength of cooperation between villages amid various regulatory challenges and formal structures from regional and central governments. This is interesting because a dynamic interplay exists between local wisdom, social institutions, and state legal structures that contribute to forming new institutions for managing water resources in disaster-prone areas.

KEYWORDS

Inter-Village Cooperation, Water Resources, Social Institutions, Disaster Prone Area

1. INTRODUCTION

Water as a system that supports the “veins” of life, in its management, often creates social friction. Water not only plays a role in meeting basic needs but also as the glue that binds social and cultural solidarity. Sometimes water can also trigger estranged social relations, for instance, conflicts. The involvement of various articulations of stakeholders, such as the state, corporations, and local communities, can be the source of conflict. Anomalous water resources management policies or regulations—as a matter of fact, often lead to conflicts between intertwined parties (Giordano et al., 2007; Gondo and Kolawole, 2019; Haddadin, 2006; Pluchinotta et al., 2018; Priscoli and Wolf, 2009). Like what happened in Marsabit, Kenya, inter-household conflicts occur due to conflicting interests in water use for the domestic needs of households and livestock; thus, the overall domestic water needs are not fulfilled (Yerian et al., 2014). However, it is not uncommon for water resources to become a catalyst for peace and conflict resolution in the community’s social system (Abukhater, 2013; Tayia, 2019; Yerian et al., 2014). Even participatory water management, including community-based initiatives, can be a supplement to reduce conflict and collaboration between stakeholders seems to be crucial (Grassini, 2019).

But on the other hand, the temporary collaboration between stakeholders often only involves local or state government elites, which results in the social order's deconstruction. Especially when cooperation is oriented to the rationality of economic benefits, intertwinement, and corporate-oriented. If the role of corporations dominates the order of cooperation between stakeholders, the destructive effect will be massive in the community, especially in sustainable water management. Cooperation between stakeholders, the government, the private sector, and the

community needs to be based on the transmission of knowledge and cooperation between actors. Even in the transformation of resource management, it is not enough only at the stakeholder level but also the participation of the wider community (Mutahara et al., 2017; Nugraha et al., 2018; Samosir et al., 2015). Cooperation can also play a role as an adaptive response to the risk of deconstruction in water resource management.

Traditional water management has values that may contradict modern water management, managed and controlled by the private sector or corporations. The paradox of water management is seen when corporate power, supported by government regulations, makes water a commercial commodity and is not distributed to fulfill the community's basic needs (Arrsa, 2015; Sudarwanto, 2015). The right to water ownership of the local community as the "legitimate" owner of the water has been marginalized since thousands of years ago. Water, which is a human right, should not be partitioned only for the benefit of commodities, especially the neoliberal global water trade chain (Vos and Boelens, 2018). Delegated to the community, compensation for water use for the management of the private sector or corporation may result in difficult access to water for local communities (Nurcahyono et al., 2015). The decommodification step is the right solution to the water problem as the fulfillment of human rights. In addition, the strengthening of the role of local social institutions in integrated water resources management ensures the sustainability of the water system as the basis of livelihood (Kalantari et al., 2018).

A group researchers also highlighted the aspects of institutional cooperation filled by small farmers in Northwest China and the participation of small farmers in institutions as a collective mixing bowl of knowledge (water conservation, village-based information, application of



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micro-irrigation systems) on water management to deal with the drought crisis (Fan et al., 2017). This association became a way of decentralizing water management policies and facilitating farmer participation. A group researchers findings stated that, community participation and local knowledge as the main fortress linked through institutions initiated by the community are vital aspects that need to be taken into account in managing, maintaining, and protecting water resources, especially to strengthen community resilience in facing disaster crises (Zamani, 2021; Riyanto et al., 2020). Aspects of local institutional cooperation, local knowledge or wisdom, and participation become an urgent drive-in water resource management, especially as a strengthening of community resilience capacity to adapt to various situations. On the other hand, social capital (bonding, bridging, and linking) as a basis for initiation naturally embedded in local community relations can increase the circular economic potential of water management. (Istiyani and Wijayanto, 2022).

On the other hand, traditional water management in responding to natural, social, political, and cultural dynamics based on the initiative and strong participation of local communities is something interesting to observe. Let's take, for example, the water management by the community in the Disaster-Prone Areas, or Kawasan Rawan Bencana (hereinafter referred to as KRB) of Mount Merapi, Yogyakarta, the most active volcano in Indonesia. When repeated disasters occur, this area has a vital role in the surrounding community because of its position and function. Cultural intelligence, adaptability, responsibility, and the spirit of helping each other affected communities synthesized into a collaboration or action plan, giving birth to a local-level social institution. KRB Merapi provides valuable lessons for the community and local institutions for resilience, adaptation, mitigation, and swift recovery (Alam et al., 2013; Dillashandy and Panjaitan, 2018; Isnainiati et al., 2014).

The formation of local institutions through community participation in water management is vital in dealing with disasters that are not easily predictable. The establishment of local institutional elements in participatory planning and policy evaluation can guarantee mitigation management through sustainable infrastructure development to ensure water resources security (Sen and Kansal, 2019). One case in Botswana, a water management policy that ignores elements of local community participation, driven by massive industry and population explosion, has proven to harm water quality (Gondo and Kolawole, 2019). The participation of various stakeholders in nature conservation, especially water, must also consider the political economy framework of conservation and participatory governance by linking the historical contours of local-based social institutions. (Bixler et al., 2015; Mahoo et al., 2015; Xue et al., 2017).

In the context of water management at KRB Merapi, the formation of local institutions seems increasingly complex because the ecological and social dynamics are also dealing with the dynamics of regulation, Law of the Republic of Indonesia No. 17 of 2019 on Water Management This has the potential to suppress the already established local water management institutions. On the other hand, the political economy framework of conservation and participatory governance is inseparable from the historical contours of local-based social institutions. Therefore, traditional water management institutions need to metamorphose into adopting modern tools while maintaining the basic values of local culture and the principle of justice in accessing water resources, which due to the changes in regulations are controlled by the state.

This research aims to analyze the Establishment of New Social Institutions

and Cooperation Processes in Water Resources Management in Disaster-Prone Areas of Mount Merapi in the Context of Ecological Dynamics, Local Wisdom, and Social Institutions. This research also discusses establishing new social cooperation and institutions in water management in disaster-prone Areas. This study identifies the role of water management social institutions (guyub bebeg) in post-disaster mitigation and recovery. The novelties of this study are (1) Empirical: In finding a model of cooperation between villages in managing water resources in disaster-prone areas, this collaboration can form, lasts, and continues because there is local wisdom and solid social institutions in communities in disaster-prone areas and rural areas. In Java. The cooperation between 4 villages between regencies and provinces took place peacefully despite potential conflicts of regulations/national laws/local values/regions and between communities. (2) Theoretical: Ecological natural processes and disasters, in the context of water management, strengthen the community's social and institutional systems, perpetuate local wisdom, and reduce social conflicts in disaster-prone areas communities.

2. READING COOPERATION AND COLLABORATION

In terms of establishing cooperation, four things can be taken into consideration for all parties involved in it, namely: first, each party must still maintain its independence. Second, each party can share risks and benefit from the results of cooperation through performance control. Third, each party has core competencies proven to be key success factors. The four cooperative relationships in strategic alliances must be based on reciprocity with the principle of exchanging or integrating specific business or non-business resources to obtain synergistic benefits (Boddewyn and Buckley, 2017). Borrowing the concept described by that collaboration is a process of participation of several entities (people, groups, and organizations) that work together in order to achieve the collective goals that have been agreed upon (Afri et al., 2021; Maskudi et al., 2022).

In addition, a collaboration also involves various resources and responsibilities to collectively operate in a participatory work cycle from planning, implementing, and evaluating programs to achieve common goals. Collaborative management is defined as an agreement between two or more stakeholders to share information, roles, functions, and responsibilities in a mutually agreed relationship and partnership mechanism. The hallmark of collaboration is a process of mutual learning (sharing), especially information sharing. In the process of achieving goals, continuous or adaptive adjustments are often made emphasize an important aspect that must be created in the formation of collaboration, namely the participation mechanism (Borrini-Feyerabend et al., 2013; Qodriyatun, 2020).

3. THREADING THE NEW SOCIAL INSTITUTIONS

There are various definitions of social institutions; in general, social institutions are multiple sets of rules, systems of organisms, social mechanisms, and rituals. The concept of social institutions is important because the core of every action and structure of society is the actualization of this concept. Human actions can change the structure, and conversely, the structure of society can encourage the actions of an individual or group. A social institution is an association of social norms created or created to perform social functions in the community, inferring that this social institution is a function that can move human activities and activities both individually and collectively in the context of a particular society.

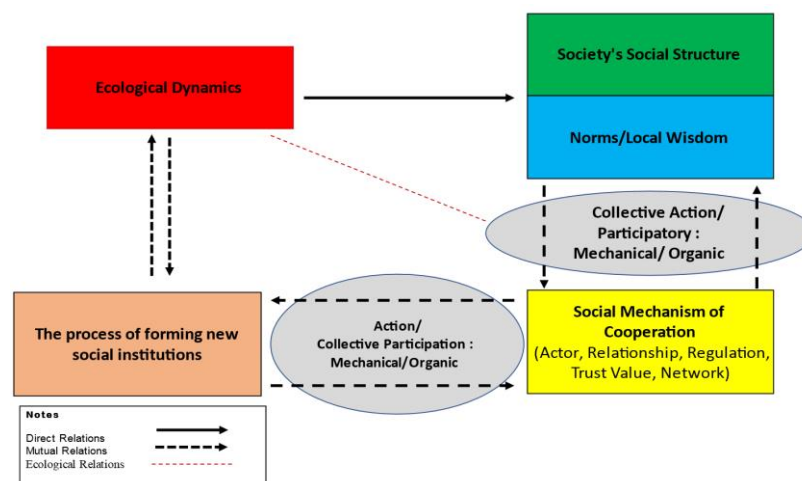


Figure 1: Framework towards new social institutions

Some researchers wrote and summarized various conceptual debates about social institutions from various theorists; (1) institutions are social, established by a group of people who have strong relationships, are related to each other and continue to repeat themselves, (2) persist over a long duration of time and over a wide area, (3) social practices are controlled by norms, (4) Social institutions are able to inhibit and encourage one's activities, (5) have specific positions, roles and goals, (6) institutions are formed because of the actions of their members, (7) the behavior and thoughts of members are internalized by the institutional system (8) institutions have an ideology created by elites, (9) In institutions there are dynamics, conflicts and sometimes inconsistent in specific contexts, (10) institutions can change and even disappear (11) Institutions are organized and influenced by power, (12) Institutions and individuals shape each other with others, (13) institutions are interdependent with other institutions, (14) institutions have links with the state (Martin, 2004; Bondarenko, 2020; Dye, 2020). From the 14 characteristics of these social institutions, in further elaboration, a group of people forms social institutions, both formally and informally, that require a relatively long time to form and can dynamically adapt to the community's needs. What has not been explained in this paper is how the functions and roles of social institutions can move the community and how the system works. The various existing pieces of literature also do not explain how the new social institutions and institutional processes are formed. One of the weaknesses of this social institutional concept is the lack of recent research that uses this concept as an analytical framework. Social institutions are the very forces that drive individuals to act (Akiyoshi, 2015; Brewer, 1963; Gomory, 2022; Jumriani et al., 2022; Steidley et al., 2017; Uphoff, 1992). Most of the literature and previous studies explain that social institutions act as "forces" that can drive individual and collective human actions in society. Few works of literature have made the human or communities change and form a new social institution. Several studies have discussed how institutional revitalization

is important for accelerating development, and the dominant factors in forming social institutions (Xia and Zuo, 2018; Yin et al., 2022; Mertzanis et al., 2019). However, from the various existing literature, it has not been explained in more detail and detail regarding the requirements and things that determine social formation, relations, actors, and structures regarding new social institutions in society.

4. METHODS

This study uses a qualitative approach. We use descriptive analysis to answer the research objectives, namely to explain systematically and in detail about the process of realizing village cooperation in water management, the driving factors and inhibiting factors of cooperation, and the development model of water management cooperation in disaster-prone areas. This study seeks to find a new institutional strategic scheme in water management cooperation. In this study, the descriptive method was designed to collect information about the real and present situation (while ongoing). This method aims to illustrate/describe systematically the nature of circumstances running at the time of implementation and examine the cause of a particular symptom.

The research sites as the unit of analysis are four villages on the slopes of Merapi that are currently still cooperating in water management: Glagaharjo Village, Cangkringan District, Sleman Regency, Yogyakarta Regional Province (DIY), Balerante Village, Sidorejo Village, Tlogomulyo Village. Middle. The four research locations were chosen based on several considerations: (1)—key locations for cross-village, cross-district, and inter-provincial water management activities. (2). It contains various rules, regulations, and typologies of different societies. (3) the allure of the location is the cooperation in water management initiated collectively and has continued to this day.

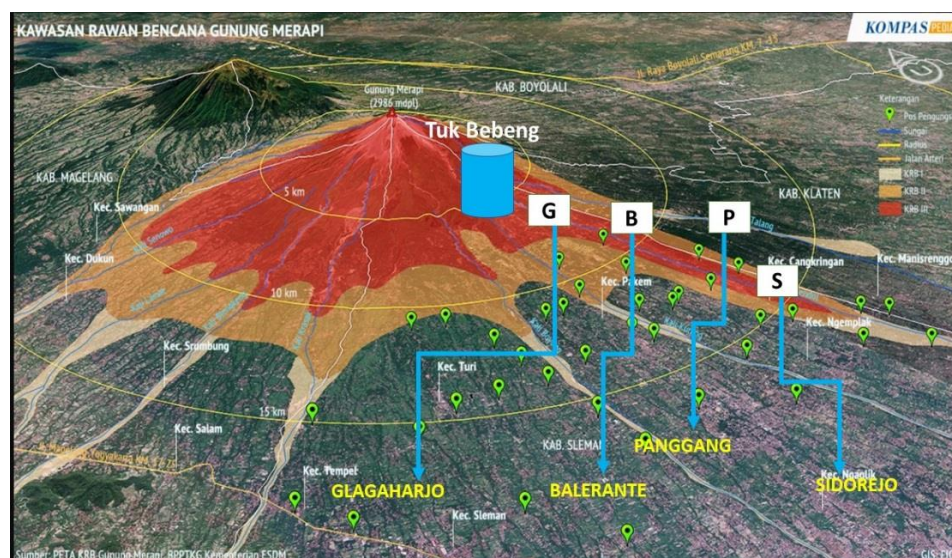


Figure 2: Mount Merapi Disaster-Prone Area. Source: (JP, 2020)

Methods of data collection by conducting in-depth interviews with key informants and stakeholders. Focus Group Discussion and participatory observation. The analysis uses textual data from various relevant documents, focus group discussions, and field observations. Data analysis uses interactive dialogue analysis method (Miles et al., 2018). The analysis step was dialogical between data collection, data organization, data reduction, synthesizing, and threading themes and patterns to answer the research objectives. Using an interactive dialogue analysis approach between these data, we try to get relevant data to the research objectives. Even post obtaining research conclusions, researchers can re-check the data from field findings and data analysis. This is used considering that this study focusing on water management collaboration is very dynamic. New discoveries like social relations and ecological conditions need repeated cross-checks between data and research results.

5. RESULT AND DISCUSSION

In this section, the results and discussion will be examined in 3 aspects, the trajectory of water management dynamics, the process of establishing new social cooperation and institutions in the context of water management at disaster-prone Areas, and the role of water management social institutions (guyub bebeng) in the process of post-disaster mitigation and recovery.

5.1 Unraveling the Trajectory of Water Management Dynamics

Water management in disaster-prone areas of Merapi has a long and winding history. The dynamics of water management are strongly influenced by natural conditions and social conditions in Indonesia, especially in Central Java and Daerah Istimewa Yogyakarta (DIY). In the 1950s, after Indonesia's independence, the predicament of the people on the slopes of Merapi experienced a shortage of clean water. In the early days of independence, Indonesia's political and economic conditions had yet to be stable, so they did not focus on water management facilities and infrastructure in disaster-prone areas. Water resources management initiatives are carried out at the local and non-governmental levels. Political conditions in 1965, as a result of the G30S/ PKI incident, greatly influenced water resources management in the KRB Merapi. This has resulted in several clean water supply projects have stagnated. After the dark tragedy of 1965 and the new order (President Suharto) came to power, political conditions began to stabilize, giving rise to various cooperation programs between stakeholders such as foreign non-profit organizations and universities. In the 1970s, water management was handled by the government at the provincial level and experienced significant development with the support of the Dian Desa Foundation in building infrastructure.

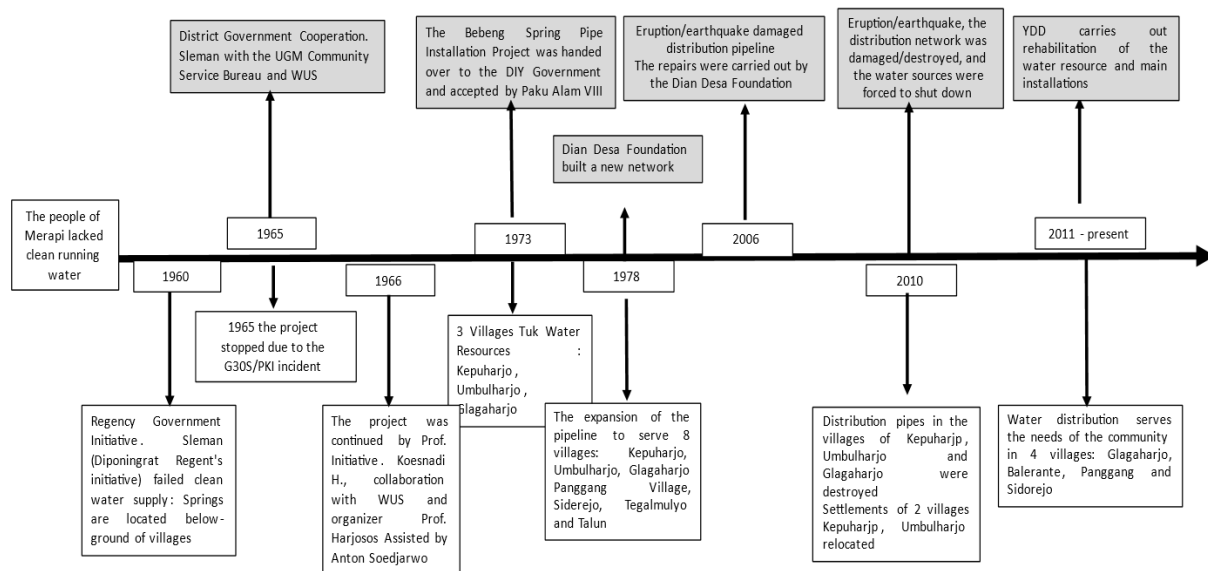


Figure 3: Water management events chronologically

The event of a devastating earthquake measuring 5.9 on the Richter scale in 2006 in Yogyakarta also damaged water installations. The Dian Desa Foundation has contributed to repairing the distribution damaged by the earthquake. In 2010 there was one of the biggest volcanic eruptions in the history of Mount Merapi, resulting in the closure of water sources and damage to the distribution network to the community. The Dian Desa Foundation had a role in repairing waterways and improving infrastructure at the Tuk Bebeng spring. Water management in the 1960-

2010 era tended to be carried out by top-down projects, even though there was already community participation back then. Community participation at that time tends to be instructional in nature from the government along with Non-Government Organizations (NGOs). Cooperation between villages in managing water is a long process of natural mechanisms and social mechanisms so that they can form new social institutions. This new social institution was created from mechanical and organic solidarity mechanisms.

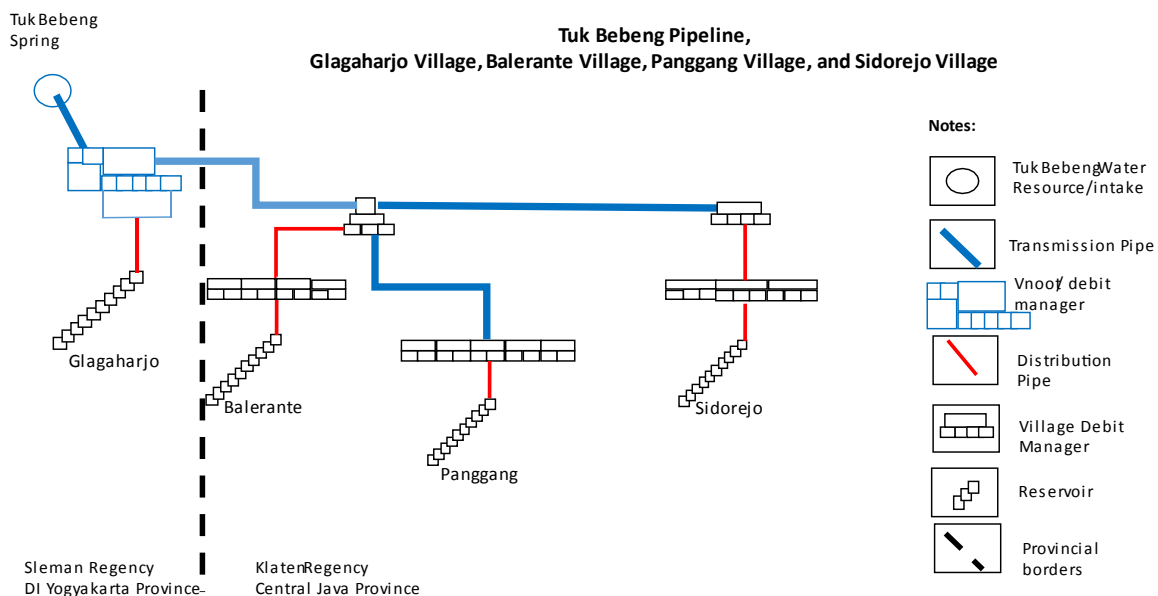


Figure 4: Tuk Bebeng Pipeline (Source: Researcher Data Processing, 2022)

Water distribution in four villages requires many pipes; the distribution length can be more than 10 KM. The implementation of these water management activities is not only technically related, but more than that, the performance of water management is an activity of mechanical and organic solidarity by people living in disaster-prone areas. Initiatives for water distribution will not be implemented if the community does not have a well-functioning social institution. Social institutions in this community can encourage community action activities for mutual welfare.

5.2 The Process of Establishing New Social Cooperation and Institutions: Participation and Mechanisms

The process of forming water institutions in water management goes hand in hand with ecological dynamics and community social dynamics. Social

institutions in water management do not appear suddenly but result from the interplay between ecological and social conditions. The cultural state of the Javanese rural community, closely related to the mechanical nature of the "gotong royong" spirit (mutual assistance), makes water management work swimmingly. The establishment of this water management social institution as a medium to meet the needs of the community in four villages that require water availability. As one of the basic needs, water availability management is vital and urgent, primarily when these four management villages are located in disaster-prone areas. Water as a resource is often contested and triggers prolonged social conflict (Angelakis et al., 2021; Dell'Angelo et al., 2018). Social institutional's stature and roles are crucial in the context of water management and sustainability.

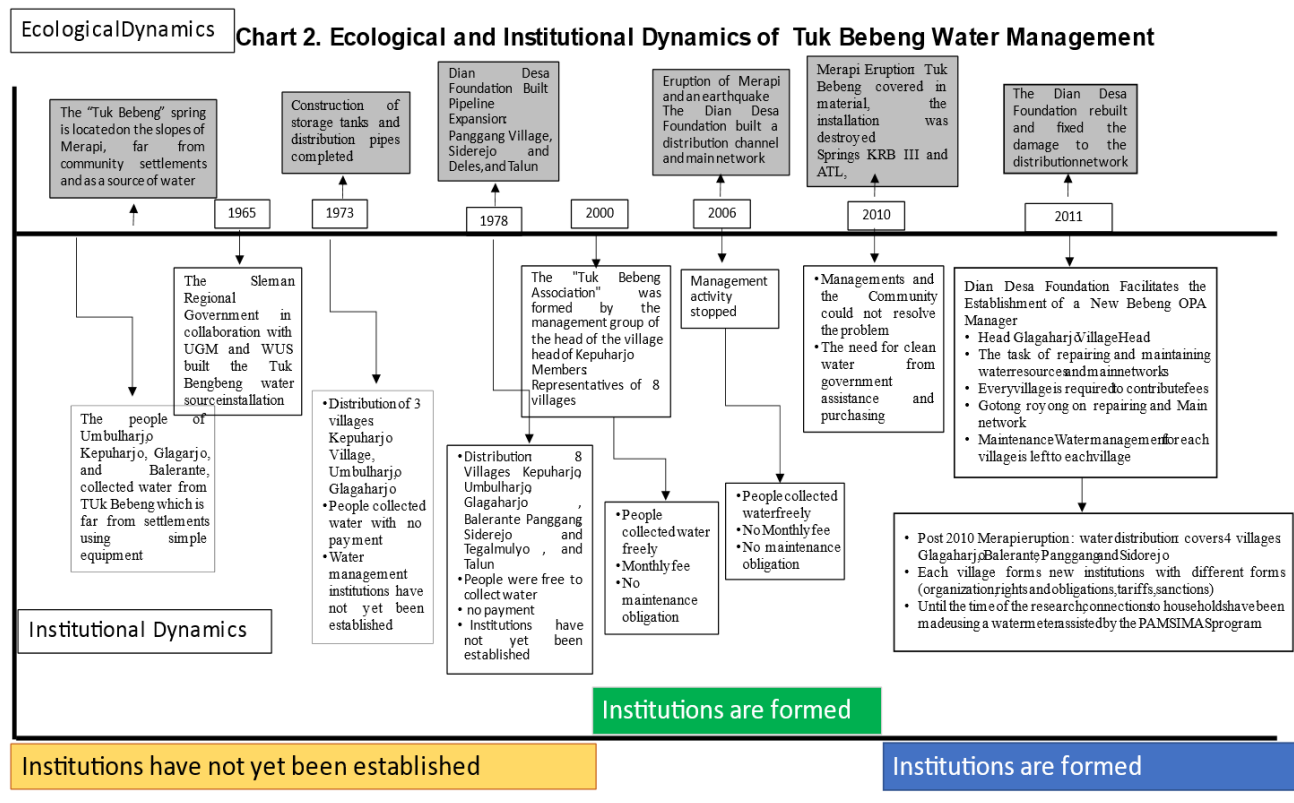


Figure 5: Institutions formation process

The formation of social institutions for water management was strengthened in the 2000s. The process of forming this institution results from the interplay between mechanical and organic community actions. In contemporary society, mechanical and organic solidarity cannot be distinctly categorized. At a specific moment, the two are intertwined with each other; at one time, mechanical solidarity is stronger, and at other times organic solidarity is more dominant. Society requires a certain dimension of solidarity, while a modern society with differentiation requires an organic division of labor (Herzog, 2018).

The process of institutional formation in this water cooperation can be said to be a "hybrid" between mechanical and organic solidarity. This organic and mechanical context adapts to the needs in the field and depends on the phase being passed. Mechanically, solidarity and cooperation are built simply with collective awareness, and there is no professional division of labor in managing water resources. In constructing a water tank, for example, all communities are involved in building water installations even though they do not have the skillset. In the early days of infrastructure formation, the community worked together to build infrastructure without basing it on expertise in a specific field. Mechanical solidarity is encouraged in water management because of the mutual need for running water. The elements of "gotong royong" and togetherness became the primary constructors at the beginning of institutional formation. In the next phase, when water needs become more complex, community solidarity adaptively becomes organic solidarity. Organic solidarity is indicated by a complex and orderly division of labor among members united due to dependence on one another's expertise. The process of water distribution and installation requires a special set of skills. In this phase and condition, organic solidarity occurs more dominantly than mechanical solidarity.

Mechanical and organic solidarity in the establishment of water management institutions is carried out collectively by community members. The Tuk Bebeng community collaborated with four village governments, Mount Merapi National Park, the NGO Dian Desa Foundation, the Dinas Pekerjaan Umum, and other parties. The collective action of this cooperation at one moment took place in a structured, semi-structured, and unstructured manner. This collective action has made water management in Tuk Bebeng fluid and flexible according to conditions. Participation in inter-village cooperation is deliberative, and no village dominates other villages. The culture of gotong royong and the principle of justice is one of the main bases for collective action to build cooperation in water management. This cultural condition then helped facilitate the flow of cooperation and forming new social institutions for water management.

The devastating eruption of Mount Merapi in 2010 shut down the Tuk Bebeng springs and water distribution installations to the community. This condition caused the community to experience a clean-running water crisis. The similarity of fate and suffering makes people think and take cooperative actions among stakeholders. These new collaboratives and institutions can be formed because of a shared vision of collective management in preserving Tuk Bebeng as a source of life and social glue. This water management collaboration consists of various dimensions that are intertwined with one another. To form cooperation and its good pattern, it needs to be a common vision/goal between one party and the other. Communities and water resources managers have the same objectives, namely that there needs to be impartial water resources management so that people do not experience any difficulties with clean running water. Bitter experiences in the past, namely during the earthquake and the eruption of Merapi, gave the community a common vision of managing water.

These shared goals and experiences are capable of driving not only individual action but also collective action. The bond of mechanical solidarity in the style of the paguyuban community is still very strong because it is united by the cultural values of cooperation and mutual assistance. The typical pattern of this community can still be found in people who have inland rural areas or mountainous areas. The rural area of the Tuk Bebeng spring is also strongly influenced by the Mataram culture of Yogyakarta and Surakarta. People in this area generally interpret nature as an older brother to humans who must be preserved. In value, Tuk Bebeng spring water is a blessing from Merapi that will not die and must be preserved and utilized for common needs regardless of administrative boundaries and area status (Conservation and KRB).

Within water management cooperation, there are various consensus, both formally and informally. The management of water cooperation is regulated officially in Law No. 7 of 2004 on Water Resources and Law Number 37 of 2014 on Soil and Water Conservation. The Tuk Bebeng spring area is located in the province of the Daerah Istimewa Yogyakarta and Central Java Province. It is located in the Mount Merapi National Park with the status of a Disaster-Prone Area/KRB Presidential Regulation Number 70 of 2014 concerning Spatial Planning for the Mount Merapi National Park Area. Consequently, various rules formally underlie the existence of this area. These formal rules are macro and often overlap. In general, the public is also less aware of these regulations. On the one hand, this regulation can benefit the community. Yet, on the other hand, some laws are more detrimental to the community, such as Regulation of the Minister of Forestry Number. 18/MenLHK/Setjen/KUM.1/4/2019 concerning Utilization of Water and Water Energy in Wildlife Sanctuaries,

National Parks, People's Forest Parks, and Eco-tourism Parks. It regulates allowed water usage in said area. They were determined for the area, 50% of minimum water debit with 30% for non-commercial/social interests and 20% for commercial purposes. On the other hand, with the issuance of Law Number 6 of 2014 concerning Villages, having authority based on

original rights. This authority gives the village the right to manage resources as long as the fact is that it has been passed down from generation to generation. Regulatory facts have not yet been negotiated, which will trigger a conflict of interest between the conservation management authorities and the Merapi community.

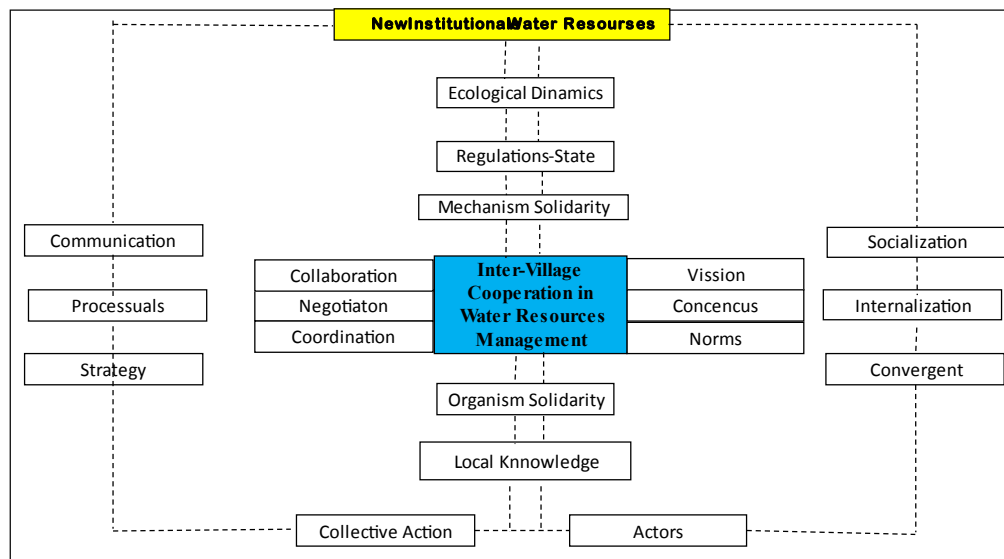


Figure 6: Mechanisms for the formation of new social institutions

In contrast to macro regulations made by policymakers, informal micro regulations proceed more fluidly and adapt to community conditions. When compared to regulations from the government, there are some fundamental differences between the two in water management systems. The consensus that exists in the water management community is present as an embodiment of the local social values of the community. From these various cultural values, the rules are based upon mutual agreement. These rules are generally not written in detail like ministry or agency regulations. Although not written in detail, the consensus at the community level has a solid binding power to direct and limit various community actions. For example, to manage the Tuk Bebeng spring, the community agrees to compel that water as an entity that must be shared fairly.

Water is not seen as a commercial commodity that can be traded freely to private companies. This consensus in society binds quite strongly and has impetus in every social action. In managing the distribution of water, for example, the springs are located in Glagahharjo village, which is in the DIY Province area. Conversely, water distribution flows more dominantly in the Central Java province. This cross-regional flow and management model is prone to conflict, especially in the utilization and distribution across administrative areas. (Gleick, 2004). This local consensus can encourage cooperation and reduce potential conflicts in Tuk Bebeng water management. So far, local consensus (informal) and state regulation (formal) can go hand in hand in water management. However, the potential for overlapping and conflicting regulations between local consensus and state regulations is like a latent danger.

The various forms of local consensus are: (a) The agreement of three representatives of Water Management from the Klaten Regency, Central Java, to appoint the Head of Glagahharjo Village as the Head of Tuk Bebeng Management; (b) Water management representatives from four villages agreed to "urunan" (chip in) as a reserve for maintenance and repair costs; (c) Paguyuban (gemeinschaft) bears the maintenance and repair of water sources and central installations (springs - main tubs); (d) Water management in each village (contributions, maintenance, repairs, conflicts between users) is left to village level managers; (e) Each village sends residents in case of damage that requires large amounts of energy. Political and social dynamics may cloud and threaten the well-established pattern of consensus and cooperation. Various stakeholders need to be aware that various regulations conflict with each other and are prone to triggering social conflicts due to water management in the community.

The collaboration between the community and stakeholders has been going well so far. However, existing collaborations on water management are incidental and unplanned for the long term. There is a pattern that is unique in this context. The collaboration will be strengthened if there is pressure on the ecological structure. A powerful earthquake with a 5.9 Richter scale magnitude in Yogyakarta in 2006 and the eruption of Merapi in 2010, had destroyed water sources and infrastructure. The catastrophe

triggers collaboration and forms a more intense collaboration between stakeholders to improve water source management and installations. This collaboration involves multi-stakeholders and multi-level stakeholders. At the community and gemeinschaft level, disasters strengthen the collaborative bonding system among water management community communities.

This bonding collaboration strengthens the social solidarity system in the internal community. Bonding in this internal community is more mechanical and traditional. All community members will carry out various repairs and construction of water installations with personnel without the skillset. This bridging collaboration strengthens the cooperation between villages, making the bonds and relationships more intense. Collaboration linking takes the form of collaboration that is broader and between levels. This collaboration forms a relationship between the water management community, NGOs, government agencies, and universities. This collaboration expands the cooperation network in water management in tuk bebeng post-ecological dynamics. This collaboration is mediated by intense communication between communities. The Tuk Bebeng Water Association has accommodated communication on the management of this spring. Communication forums between communities strengthen social relations and actions for the sustainability of the Tuk Bebeng spring.

Coordination in the management of Tuk Bebeng takes place in a convergent manner. These various convergences can be typified into structured, semi-structured and unstructured coordination. Coordination in managing springs in one condition is structured, such as what is done by the Dian Desa Non-Governmental Organization and International NGO in managing springs. At the management level, the association and the community, more coordination is carried out using semi-structured and unstructured methods. In the initial phase, at the time of the formation of management and institutions, coordination is more structured. However, when the management is running and during monitoring and evaluation, the coordination carried out by the manager is more on an unstructured method.

The coordination pattern is determined by the dynamics of ecological and social conditions. This form of coordination includes (a) Collective management of 4 villages through deliberative principles. Each village head represents the Paguyuban and the representatives of water management social institutions (Glagahharjo, Balerante, Sidorejo and Panggang); (b) Each party between the Paguyuban and the management group at the village level is relatively equal (no party dominates and intervenes in water management - distribution of rights and obligations); (c) The position between managements is equal, and the bargaining position of each manager with the user community is relatively based on values, norms, *keguyuban* (community spirit)/ *gotong-royong* (mutual assistance).

The negotiation process has continued from the beginning of the management of tuk bebeng until now. These negotiations cannot be separated from the administrative conditions and different patterns of interest in society. Negotiations have been soft so far, and there has been no potential for serious conflict. There was a deliberative dialogue among the water user communities in the negotiation process. Javanese rural communities, especially people close to the center of the palace, have a typical hierarchical and feudal pattern. This deliberative dialogue process became an anomaly in a society with a robust feudal character. In a hierarchical social system, actions are not entirely delegated to specific figures or actors if the actor is not siding with the community.

The process of deliberative dialogue on water management negotiations became an exciting finding in the community with feudal culture. The leading actor as a network is Anton Sujarwo (director of the Dian Desa Foundation), who acts as a technical consultant and fundraising when the main springs and installations are seriously damaged and cannot be handled by the Paguyuban and managers at the village level. BPBD Kabupaten and Sleman, as disaster risk management and mitigation authorities, always contribute to rehabilitating damaged water distribution networks.

The various dimensions of the cooperation carried out by the stakeholders of this management flow indirectly formed a new social institution. This new social institution is characterized by the following:

- 1) Innately social institutions, founded by a group of people who have strong relationships, are related to each other and ever-recurring. Previously, these inter-village community groups did not have strong relationships. Ecological processes and social mechanisms in the community strengthened new social relations between groups in managing water resources.
- 2) This new social institution can survive for a relatively long time (more than a decade) and reach a wide area, i.e., four villages across provinces.
- 3) Norm-controlled social practices, these new social institutions are still influenced by the old norms with some adaptation adjustments to community needs, and the community is already accustomed to these norms.
- 4) Social institutions can inhibit and simultaneously encourage the activities of the water management community. New social institutions that manage water tend to be able to promote community activities and water distribution in a more just and prosperous manner.
- 5) The new social institution for water management has a position, role, and purpose of fulfilling and prospering the community.
- 6) This new social institution was established because of collective social action. This social action was triggered by a common goal and the ecological dynamics of Mount Merapi.
- 7) The behavior and sentiment of members are internalized by the new social institutional system for water management. Prior to 2010, there was no institution capable of uniting aspirations and actions in managing water.
- 8) The institutions have goals that are created together.
- 9) Water management institutions have their own dynamics and conflicts, at times inconsistent in specific contexts. Conflicts have so far been subdued because there are values of togetherness and *gotong royong*, or mutual cooperation, which are internalized in people's minds.
- 10) Institutions are organized and influenced by power, yet also heavily influenced by ecological dynamics.
- 11) Water institutions and individuals shaped one another,
- 12) Institutions are interdependent with other institutions, namely political dynamics, regulations, and social dynamics.

5.3 New Social Institutions as The Drivers of Water Management: from Mitigation to Recovery

The springs are also a blessing of livelihood for the people on the slopes of Merapi. The sacredness of water as a life support of the people of Merapi, symbolizing the link between several villages that flow from upstream to downstream. The Tuk Bebeng became one of the springs supporting

people's lives. Its stream crosses four villages from two regencies and administrative provinces; Glagaharjo Village, Cangkringan District, Sleman Regency, Yogyakarta Regional Province (DIY), Balerante Village, Sidorejo Village, and Panggang Village. All three belong to the District of Kemalang, Klaten Regency, Central Java Province.

Tuk Bebeng, the water flow, and the four villages (Glagaharjo Village, Balerante Village, Panggang Village, and Sidorejo Village) are included in the category of Disaster-Prone Areas (KRB).

The position of the four villages and Tuk Bebeng in the KRB has great potential to be affected by various disasters such as eruptions, incandescent lava, and hot clouds. In 2010 when the Merapi eruption disaster occurred, it became a turning point for the birth of better public awareness to act collectively and care for each other. At the same time as the eruption occurred, the incandescent lava flow was destructive to Tuk Bebeng, so the water flow became stagnant. The eruption disaster in 2010 and the destruction of the Tuk Bebeng water source have strengthened the community's volunteerism to care for their living Tuk Bebeng water source. Along with the periodic disasters that hit the people of Merapi, it also gave birth to a local institution with solid roots in the community, namely Guyub Bebeng.

Tuk Bebeng is the primary water source that distributes water to four villages for agricultural, livestock, and domestic irrigation purposes. This Tuk Bebeng water source irrigates to meet the community's needs of almost 2871 people spread over four villages. Interestingly, the community collective self-manages the Tuk Bebeng water tank. Guyub Bebeng has been transformed into a local mechanical institution based on mutual cooperation and togetherness. The collective actions and actions of the people of these four villages, manifested in the Guyub Bebeng institution, have become a preventive "natural fortress" to protect, maintain, protect, and have a strong sense of belonging to the Tuk Bebeng water source. The people of the slopes of Merapi understand that water is a source of their livelihood, and they must maintain it for sustainability. The community's collective attitude is a way of respecting nature for its blessings (nature) as their life support. This attitude then manifested in the local institution "Guyub Bebeng" on the slopes of Merapi. Inevitably, this attitude of awareness grows in the "Guyub Bebeng" institution as a collective belief in cooperation based on a sense of belonging, care, nurturing, and sustainability. (Singha, 2016; Valizadeh et al., 2018).

The authority for water management in each village is not regulated by the "Guyub Bebeng" institution but is left to the water manager at the village level. Each village has to include representatives from the Village Government, the Badan Permusyawaratan Desa (Village Consultative Body/BPD), community leaders, user representatives from each hamlet/Neighborhood Association, and Village-level water managers. Based on the agreement, the cost of using water in Balerante Village is set at IDR 4,000/m³ (USD 0.25/m³), load costs IDR 3,000 (USD 0.20), and if it exceeds 15 m³, a progressive rate of doubling IDR 8,000/m³ (USD 0.5/m³) is imposed. It is different from the rate set by the manager in the other three, Glagaharjo Village of IDR 5,000/m³ (USD 0.30/m³) and a load cost of IDR 4,000/month (USD 0.24/month), Panggang IDR 7000/m³ (USD 0.45/m³) load costs IDR 4000/month (USD 0.24/month), and Sidorejo Village IDR 5000/m³ (USD 0.3/m³) and load costs IDR 4000/month (USD 0.25/month). The cost of damage to the network installations of three villages, Balerante, Sidorejo, and Panggang, has the same rules; in the residential area, the cost is charged to the user, while the village level manager fully takes the damage to the customer network in Glagaharjo Village. Among the four villages that use water from Tuk Bebeng, the water cost for Tuk Bebeng at the village level sets the highest tariff. The agreement was reached to avoid resentment among users in the two hamlets who, until now, use water sourced from deep wells managed by the community due to the limited water flow from Tuk Bebeng.

In the context of inter-village cooperation, an agreement was established regarding the maintenance, maintenance, and repair of damage to the main network that connects the Tuk Bebeng water source with the distribution tank. Based on the agreement, the representatives of each village who are members of the Guyub Bebeng institution are set for a fee of IDR 5,000/month (USD 0.3/month). If the damage requires labor, each village sends workers in turns to work on repairs in mutual cooperation without work wages. This uniqueness characterizes the attitude of the people of Merapi, the four villages, who continue to work together to protect Tuk Bebeng's spring. On the other hand, the manager has the same agreement for network damage at the village level, which is the manager's responsibility.

Table 1. Distribution of Water Resources managed by Guyub Bebeng

No	Village	Name of the Village Group of Guyub Bebeng's Social Institutional Subsystem	Percentage of Water Sharing (Consensus)	Water Distribution in Meter Cubic	Water User (household)	Dimensions of Contributions, <i>Gotong royong</i> , Maintenance, and Care
1.	Glagaharjo	Dukuh	40%	4000m ³	521 Households	Voluntary
2.	Balerante	Tirta Kencana	20%	2000m ³	692 Households	Voluntary
3.	Panggang	Tirto Roso	20%	2000m ³	600 Households	Voluntary
4.	Sidorejo	Tirta Rejo	20%	2000m ³	1058 Households	Voluntary

Source: Researcher Data Processing, 2022

The four collective beliefs underlie Guyub Bebeng's manifestation in the people's awareness of Merapi. First, the sense of belonging, this sense of belonging to Tuk Bebeng, emerged when the 2010 eruption hit. The community seemed shaken that when the water source died, the ecological livelihood of Merapi, including its people, would be distorted. This distortion then disrupted the balance of life's fulfillment cycle, such as irrigation drought—crop failure, dysfunction of domestic household needs, and diseases due to unhealthy water consumption. This sense of belonging to Tuk Bebeng strengthens the community's belief that if the water supply is interrupted, their life support system will not work well because water is a source of livelihood for the people of Merapi. Second, a sense of care for Tuk Bebeng also creates a sense of collective concern, caring for the shared fate suffered when the eruption occurred. This concern is not only about how to save each other when a disaster occurs but is manifested in Tuk Bebeng, the water source for their lives. Caring for the water source of Tuk Bebeng means caring for the benefit of all the people on the slopes of Merapi. The people of Merapi believe that when people ignore and disregard Tuk Bebeng, a massive and destructive disaster will be inevitable.

Third, the sense of nurturing, the sense of nurturing Tuk Bebeng, becomes an advanced awareness. It cannot be separated that Tuk Bebeng needs to be maintained. In all important respects, the water in Tuk Bebeng is not considered a "dead entity" but a living entity that provides blessings, so it needs to be nurtured and guarded with a wholehearted willingness (Hamel, 2021). People in the four villages are perceptive that Tuk Bebeng

is a blessing for their livelihood and the glue of their relationship. Water, for them, is a sacred reality that needs to be protected and maintained to unceasingly shower and quench the community's life (Ayhuan et al., 2021).

Fourth, the sense of sustainability arises after a sense of caring and nurturing. The feeling of keeping Tuk Bebeng so it can still irrigate, and fill water reservoirs cannot be separated from maintaining the livelihood cycle for the people of Merapi. The four villages in Merapi know that the water in Tuk Bebeng must not stop flowing and that Tuk Bebeng water is an entity that needs to be maintained and protected for its continuous flow. The sense of preserving the sustainability of Tuk Bebeng to continue irrigating life in the Merapi community is manifested through community volunteerism. Through the Guyub Bebeng, they set aside wealth and energy through contributions and mutual assistance when various damages hit Tuk Bebeng due to the Merapi Eruption.

The interaction between water and society as a substantial element that connects many domains of social life is called the hydrosocial cycle (Boelens et al., 2016; Müller and Levy, 2019; Wesselink et al., 2017). In the context of Merapi, Tuk Bebeng water, managed by Guyub Bebeng, emphasizes that water is the substance of life's balance between nature and human interactions. Humans cannot live without water, a source of livelihood for human beings. This balance of caring for each other has become the awareness of the community to act through Guyub Bebeng to maintain water sustainability in Tuk Bebeng. Anyone who has had a sip of the water from Tuk Bebeng means they are physically and mentally bound to Tuk Bebeng. Hence there is an obligation to maintain the sustainability of Tuk Bebeng and the surrounding ecological support.



Figure 7: The manifestation of the Sense of Sustainability Guyub Bebeng's Spontaneous Reaction to his willingness to restore Tuk Bebeng's water flow (Source: Research Documentation, 2022)

In addition, the local Guyub Bebeng institution as a system consists of a subsystem supporting the Guyub Bebeng community system. The subsystem of Guyub Bebeng, namely Glagaharjo Village, represented by Hamlet, Balerante Village, represented by Tirta Kencana, Panggang Village, represented by Tirto Roso, and Sidorejo Village, represented by Tirta Rejo. Guyub Bebeng, a collection of these subsystems, is the driving force for water management. The hydrosocial cycle offered by has similarities with the cyclical way of water and community relations (Linton and Budds, 2014). The interaction between water and society has the power as an entity that is intertwined with various social domains. In relation, water is not only a source of livelihood but also as the glue for social exchange. Tuk Bebeng spring as a reinforcement and a driving force for the relationship of the Guyub Bebeng.

Guyub Bebeng works naturally as a local institution for water management in Merapi as mitigation and recovery. Guyub Bebeng is a water management institution that integrates all related entities from the four villages where it flows. Water is a unifying symbol in the local institution of Guyub Bebeng. The mechanism of the Guyub Bebeng social, institutional operational scheme in water management, especially in Disaster Prone Areas (KRB). There are four important steps in looking at the social institutions of Guyub Bebeng in the participatory and sustainable

management of water resources. These four steps are the operational motor of Guyub Bebeng from mitigation and restoration of water management. These steps are carried out through institutional-based local participatory planning, implementation, sustainable village development audits, and evaluations.

These four steps are then interconnected to form a unit that complements each other in managing Tuk Bebeng water resources. Tuk Bebeng water resources management in this Disaster-Prone Area is divided into three phases. The first phase is control. There is a sense of concern for the impact of disasters through a shared understanding of disaster mitigation, protection of affected residents through community participation through dialogue and village discursive (information sharing, social mapping of disaster-prone areas, regulation of socio-economic development, and identification of affected residents. disaster). The second phase is collaborative action (disaster mitigation education based on local social and economic support) by strengthening the capacity of disaster prevention and management and social learning through knowledge sharing and local wisdom. Next, the third phase, recovery, and transformation through participatory monitoring and evaluation

It should also be noted that the 2010 eruption of Merapi has provided lessons for people whose livelihoods depend on the slopes of Merapi.

Disasters that periodically “routinely” approach the Merapi Slope community make them naturally able to act adaptively and mitigate so that they can resist all catastrophes. Mount Merapi is an affirmation of belief for its people as a symbol of strength that can provide a basis for fulfilling their lives. The basic life cycle of the lifeblood of the Merapi people is driven by local economic motors from the agriculture, plantation,

livestock, and tourism sectors (Herawati and Winarno, 2020; Muktaf, 2017; Nurokhman et al., 2021). In addition, sees one of the local wisdom in the form of oral knowledge believed by the people of Merapi; “*Eyang Merapi lagi ewuh, ojo cedhak-cedhak, lan ojo ngrusuhi*” (“Grandy Merapi is about to hold an event, don’t come near, and do not disturb”) (Gunawan, 2015).

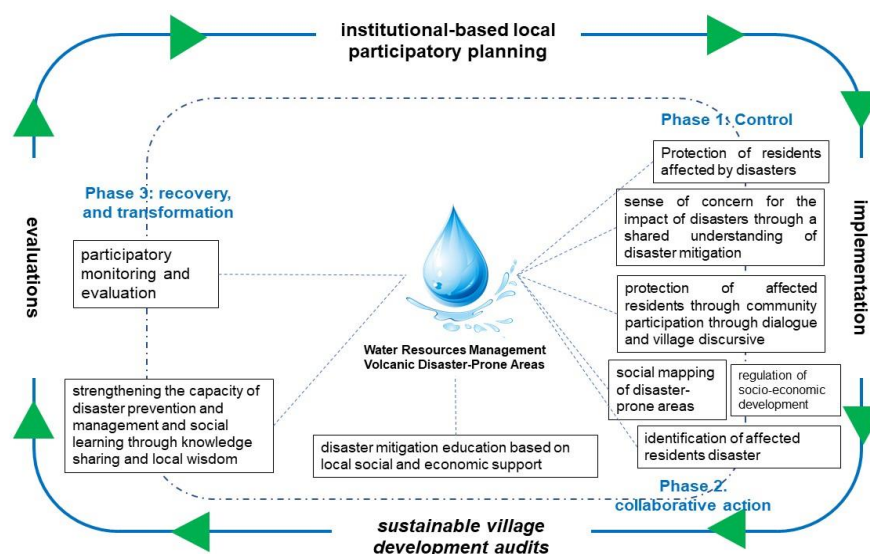


Figure 8: Guyub Bebeng's social institutional work scheme framework

Local wisdom derived from the knowledge and experience of the Merapi community has been imprinted into an adaptive habitus for the basis of mitigation efforts and early detection of the Mount Merapi disaster (Ghassani, 2017). There is one system of local wisdom that people believe as knowledge for adaptive coexistence with Mount Merapi. When a series of disasters such as volcanic eruptions emit incandescent lava, pyroclastic flow, and volcanic ashfall, it reflects *eling* (self-awareness) the local's outlook to be patient, *nrimo* (accepting the situation) and embracing the fate from God Almighty. This community's outlook and awareness also confirm the idea of their descent from the soil of Mount Merapi so that in any situation occurring at Mount Merapi, they must maintain life on their land and refuse to be relocated and transmigrated (Permana and Hartanto, 2019; Suaka, 2020; Urbayatun and Diponegoro, 2015).

6. CONCLUSION

This study examines many aspects related to the formation process of water management social institutions in disaster-prone areas. The mechanism of water management social institutions such as Guyub Bebeng manifests collective power in the community on Mount Merapi. Local actors become the driving force in water management in Guyub Bebeng with the intertwining of solidarity able to mobilize community participation. Local actors are deeply concerned about helping the people of the southern slopes of Merapi obtain clean water on a large scale and act as technical assistants and initiators of the formation of cross-village organizations/groups to manage water. Water management social institutions traverse and form through an agreement mechanism without overriding the pre-existing social institution of water resource management. Moreover, Air Tuk Bebeng strengthens and acts as the activator within the Guyub Bebeng association. Air Tuk Bebeng functions organically as a lasting local institution for water management in Merapi. Guyub Bebeng embodies the unity of local institutional cooperation, emphasizing water management in disaster-prone areas (KRB). It takes the lead in initiating post-disaster recovery and mitigation measures. This inter-village collaboration, coupled with the essence of Guyub Bebeng, serves as a platform for communal learning, fostering collaborative action. Such actions, rooted in local socio-economic support, aim for disaster mitigation education, fortifying water management capabilities in high-risk areas. Consequently, it can be concluded that cooperation based on local institutions significantly strengthens collective resilience. This cooperation ensures the sustainable provision of clean water to communities, mitigating the dire consequences of water shortages in vulnerable regions.

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