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COMMUNITY-BASED IRRIGATION MANAGEMENT AND THE ROLES OF WATER USE ASSOCIATION IN CEPU DISTRICT, BLORA REGENCY, INDONESIA

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1 RESUMO

Esta pesquisa tem como objetivo examinar o papel da associação de usuários de água no Distrito do Cepu e sua contribuição para o desenvolvimento da gestão dos recursos hídricos de pequena escala. Realizou-se uma análise descritiva para tirar conclusões dos fenômenos observados, onde os dados foram coletados e analisados por meio de técnicas quantitativas e qualitativas. De acordo com os resultados existem três padrões de gestão dos recursos hídricos no Cepu: irrigação de superfície, uso de água subterrânea e uso de água de chuva, que também indicam a variação do manejo da irrigação nas comunidades. Associação de usuários de água (AUA) pode motivar os agricultores a aumentar a taxa de cultivo em até quatro vezes por ano (duas vezes para o arroz e de uma até duas vezes para produtos hortícolas), tornando mais fácil para os agricultores gerenciarem a água através do primário, secundário e canal terciário de irrigação. Além disso pode facilitar aos agricultores a proposta de financiamento para aquisição ou manutenção de infraestruturas de irrigação, fornecer uma plataforma para produzir padrões e administração para gestão conjunta da irrigação, obtendo assim melhores receitas, enquanto a troca de informações pode ocorrer entre os membros da AUA e promover a ajuda mútua. O estudo concluiu que a gestão coletiva por meio de grupos sociais, Associação de usuários de água, tem um impacto positivo sobre os membros.

Palavras-chave: ação coletiva, grupo de agricultores, gestão dos recursos hídricos.

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2 ABSTRACT

The research aims to examine the roles of water use association in Cepu District and their contribution to the development of small-scale water resource management. Descriptive

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analysis was conducted to draw conclusions from the observed phenomena, where the data was collected and analysed using quantitative and qualitative techniques. The results show that there are three patterns of water resource management in Cepu, namely the surface irrigation, groundwater-use and rainwater-use which also indicate the variation of the irrigation governance in the communities. Water Use Association (WUA) can promote farmers to increase farming index up to four times per year (two times for paddy and one up to two times for horticulture products), facilitate farmers managing water through primary, secondary and tertiary irrigation canal, facilitate farmers to propose fundings for procurements or maintenances of irrigation infrastructures, provide platform for producing norms and governance for joint irrigation management for better income while information exchange can appear within WUA members, and promote mutual assistance. The study concludes that collective management through social groups, Water Use Association, have positive impact for the members.

Keywords: collective action, farmers group, water resource management.

3 INTRODUCTION

Water is one of the most important elements in the agronomic process. In food production, water resources are one of the key elements in agricultural activities. The use of water for agriculture activities are for food, livestock, and irrigation. Water resources that can be utilized by agrarian communities in Indonesia can come from rainwater, groundwater, and surface water such as lakes or rivers. Water resource management is essential because water availability support sustainable food production. Mismanagement of water resources can damage ecological systems and lead to the inability of nature to support human life, as stated by Hardin (1968) in his article "The Tragedy of the Commons". Even though many scholars critique Hardin's argument that overpopulation is not the only factors depleting the ecosystem, Hardin's tragedy of the common can still be a good reminder for a better management of shared natural resources. Ostrom (1990) proposed a more nuanced perspective that shared natural resources can be successfully managed with good governance and collaborative management. Other scholars have also found that better governance plays vital role in addressing water crisis (D'ODORICO *et al*., 2018; PAHL-WOSTL, 2019).

Water management is an activity carried out by agrarian communities to support food production. Government programs through the Ministry of Agriculture and the Ministry of Public Works and Public Housing are also widely implemented to help farmers manage water resources effectively. However, the center of attention on issues related to water resource management or irrigation is technical and economic issues. Often social aspects about irrigation managers or between individual farmers with irrigation patterns are ignored. The number of studies that discuss social aspects of water resource management is also not done much so that there is a knowledge gap of the topics of community-based irrigation management. Unfortunately, the relevance of societal learning and multi-level governance has been underrepresented (BAKKER; MORINVILLE, 2013; PAHL-WOSTL *et al*., 2013).

According to Government Regulation Indonesia N 20 (2006), irrigation is defined as the business of supplying farm with water through various types such as surface irrigation, swamp, underground water, pumps, and ponds. The scope of

irrigation includes water supply by opening and closing sluice water gates, disposal of residual water, distribution of water and maintenance of irrigation networks. Irrigation area is an area unit that gets water from an irrigation network. Irrigation areas are usually divided into irrigation plots which are categorized according to the location of the plots on the irrigation network. Provision of irrigation water is determined by the amount of water per unit of time or the distribution of water allocation and the main network to tertiary plots or smaller plots. As mentioned by Hussain *et al*. (2006) irrigation contributes to poverty alleviation in rural area. Farmers in the location where smaller irrigation systems are combined with well-managed infrastructure, well-distributed water, more cropping patterns and easy market access are more likely to be better-off.

As the climate is closely related to the terrestrial water cycle, climate variability will impact on the water supply for irrigation. Changes in temperature and precipitation will also have an immediate impact on the water budget (POKHREL *et al*., 2021). Over the past century, water use has increased at a rate that is more than twice as fast as population growth (FAO, 2018). This will worsen the situation in regions that already have water stress and cause water stress in areas that now have enough water resources. According to (UNESCO; UN-WATER, 2020), every continent have already experienced water stress. In Indonesia, the combination of both water availability and water demands for irrigation becomes the challenges of the declining status of watershed (HERYANI *et al*., 2022).

Environmental crisis and climate change hit hard the agrarian communities around the world as they hardly depend on ecosystem services (VERMEULEN *et al*., 2012). Local communities are getting more concerned about the complex socio-ecological issues related to climate change. A significant body of literature mentions that community collaboration and participation is important for climate adaptation (STERN; COLEMAN, 2015; LACEY *et al*., 2018; CVITANOVIC *et al*., 2021). More specifically, literatures on irrigation and water management also asserts the importance of stakeholder coordination and community collaboration (WHEELER *et al*., 2018; VOS *et al*., 2020; NALUMU *et al*., 2021; ZWICKLE *et al*., 2021). Social capital development can play significant role in promote rural development and environmental sustainability (NEUMEIER, 2017; CHAUDHURI *et al*., 2020).

In terms of farming, rural communities cannot be separated from the interaction between farmers. Interactions between farmers often occur to exchange life information and related information about agriculture. According to Walgito (2007), social interaction is a relationship that occurs between one individual and another individual that can have an influence between these individuals, so that there is a reciprocal relationship. Social interaction can provide positive impact in the form of social learning and promote knowledge acquisition, such as (PRATIWI; SUZUKI, 2017):

Friendship network: interactions among farmers that results in knowledge exchanges and cooperatives,

Peer-advising network: networking performed by farmers within community, but mostly involves some people who are considered as experienced farmers,

Government-advising network: networking activities that involves people or expert represent government institution such as agriculture extension workers, engineers, consultant, etc.).

Social interaction is a dynamic relationship that is not only cooperative, but can be in the form of competition, action, competition, and conflict (BASROWI, 2005). Social interaction promotes social learning among individuals as they can learn the proper behavior of their social group

(DUFLO; SAEZ, 2003). In the context of irrigation management, societal learning may empower farmers and promote participatory development (PARRY *et al*., 2020). Another evidence shows that with the limited roles of government, collective action that being resulted from social interaction can produce social innovation in the form of community-based governance (RONDHI *et al*., 2020).

Farmers in farming activities cannot be separated from the existence of social interaction. In the context of Cepu as our research location, the interaction between irrigation farmers who have different geographical characteristics is a topic of interest. Farming carried out by farmers definitely needs water for plant growth. Therefore, water need is met through performing irrigation managements. In acquiring water, farmers in Cepu District, Blora Regency are performed irrigational activities individually or in groups with various types and patterns. The management is carried out in an organized group through the Water User Farmers Association (WUA). The distribution of irrigation water operated within farmer groups or individually, and thereby dynamic social interactions, occur between one farmer and another. For this reason, this research aims to examine the proles of Water Use Association in Cepu District and their contribution to the development of community-based water resource management.

4 MATERIAL AND METHODS

4.1 Water Resource Management: Historical and Geographical Perspectives

Irrigation plays a significant role increasing food productivity. In Java, the revolution of irrigation system and infrastructure have started from the period of 1950s-1980s. In 1970s, irrigation managements in Central and East Java, were coordinated by Ulu-Ulu, the village officer responsible for the irrigation management. In early 1980s, many rural communities started to perform participatory irrigation management namely Dharma Tirta. By the 1990s, government played role in coordinating the irrigation groups to legalizing the irrigation institution, especially those who utilized tertiary system, into water usage association (Persatuan Petani Pemakai Air – P3A).

Historically, Indonesian government prioritized tertiary irrigation systems (TISs) as the smallest irrigation system to be primarily managed by farmers. However, after financial crisis in 1988, as the crisis impacted in budget cutting in irrigation management, the primary and secondary irrigation system was also transferred to farmers. With the dynamics of irrigation management in the farmers institution, the government have reclaimed the coordinating actor for managing first and secondary irrigation system since 2004 but have left the management of tertiary irrigation system to farmers institution. According to Government Regulation Nº 70 (2004) on Water Resources, the division of authority for the management of irrigation networks is based on the area of rice fields served by the irrigation network. The authority of the Regency Government has authority if an area of rice fields is under 1000 ha, while the Provincial Government has authority over an area of 1000 – 3000 ha, and the Central Government has the decision-making power if the area is over 3000 ha. Irrigation for an area smaller than 1000 ha can be managed by others besides the government.

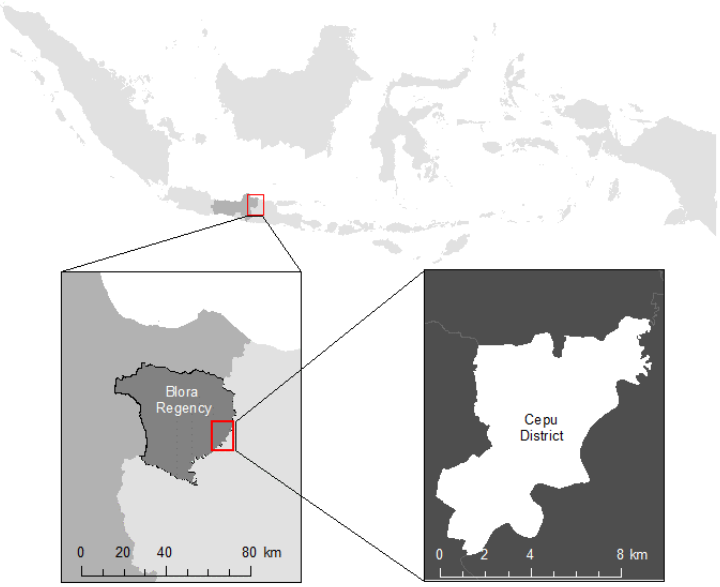
4.2. Methods

The research was carried out in 2019-2020, using qualitative and quantitative methods to search, collect, process, and analyse data because research problems are social and dynamic. According

to Creswell and Creswell (2017), qualitative research is a scientific research process to understand human problems in a social context by creating a comprehensive and complex picture, reporting the views of informants, and carrying out the study without researcher intervention. The qualitative research design involves three activities, namely descriptive stage, verification stage, and grounded research stage. This study used a qualitative method with a descriptive design, namely research that provides a careful description of certain individuals or groups about the circumstances and symptoms that occur. The descriptive approach is able to present a specific picture of the situation, social issues, and relationships, so that researchers are able to dig deeper and or photograph social situations that will be studied thoroughly, broadly, and deeply (NEUMAN, 2009).

The selection of the research location was carried out purposively in Cepu District, Blora Regency, Central Java (Figure 1) with the consideration that this location has a geographical variation of water sources. In collecting data, we conducted Focus Group Discussions (FGDs) and interview. FGDs have been conducted twice. The first FGD was conducted with six key farmers purposely selected from six villages in Cepu, and second with extension workers. The first FGD aimed at gathering information about the geographical differences and arrangements of irrigation in Cepu, District. The second FGD was conducted to validate the results of first FGD and gather additional data. In addition, a survey was conducted to 40 Water Use Association's (WUA) members that were selected using simple random sampling technique to investigate the roles of Water Use Association in joint management of water resource. According to Shareia (2016) due to the small sample (40 people) descriptive statistic is employed in this study.

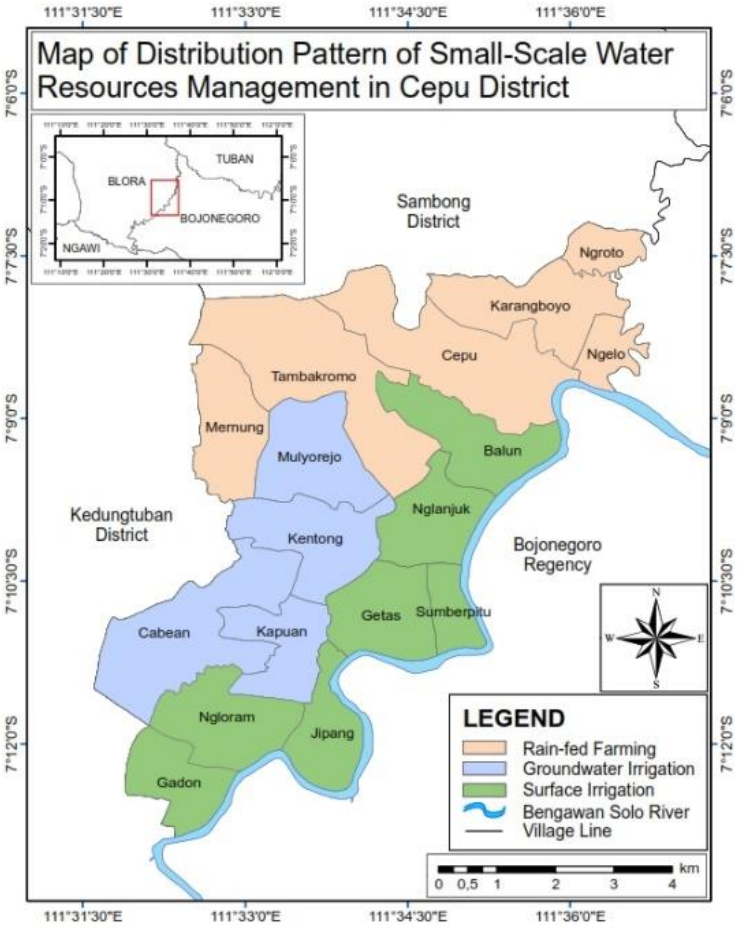
Figure 1. Figure of Study Area in Cepu District, Blora Regency.



5 RESULTS AND DISCUSSION

The research discovered three general patterns of water resource management carried out by the agrarian communities in Cepu District, namely surface irrigation, groundwater irrigation and rainfed farming. The patterns also indicate the geographical differences which led to the different mechanisms in managing water. The map of the distribution of water use is shown in Figure 2 below.

Figure 2. Distribution Pattern of Small-scale Water Resource Management in Cepu District



5.1 Surface Irrigation

Cepu District in Blora Regency is one of the areas traversed by the Bengawan Solo River. As located in the Bengawan Solo Watershed, several villages located in the eastern part of Cepu District have made use of the water resources from Bengawan Solo River, especially in meeting water needs for their farming activities. However, not all villages in Cepu sub-district are traversed by the river, so the irrigation patterns applied are very diverse. The diversity of irrigation patterns has an impact on the farming arrangement.

Some villages in the Cepu sub-district which are located next to Bengawan Solo River apply a surface water irrigation management. Surface irrigation uses irrigation networks such as ditches which are fed by water from the Bengawan Solo River which provides large amounts of water. Water from Bengawan Solo is pumped into primary, secondary and tertiary irrigation networks that lead to plots of agricultural land for farmers. The ownership

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of pumps in this area varies from pumps managed by village institutions, farmers groups, and individuals. The production costs for managing the pump machine and the fuel vary among farmers, depending on the arrangement of the irrigation management (group or individuals) and the type of fuel (diesel or electricity).

Irrigation technology began to be used intensively starting in the era of the Green Revolution in 1973. The system used was a system where water from big river is pumped to the pipes into primary channel (*gelontoran* system). For the purpose of efficiency in accessing irrigation, infrastructure development is carried out by adding a method of utilizing pumping machines by relying on diesel fuel through the government's project named Supporting Infrastructure Development Program for Disadvantaged Areas.

5.2 Groundwater Irrigation

Agricultural areas in the southwest of Cepu District, such as in the villages of Kapuan, Cabean, Kentong, and Mulyorejo, are not passed by the Bengawan Solo River. As a result, activities in acquiring water for agricultural activities in these areas are carried out by utilizing water from deep groundwater. The groundwater is a source of water that comes from the ground which is pumped out to be able to irrigate farmers' rice fields.

The use of deep groundwater in the southwest area of Cepu District began because there was not enough water from rainwater for irrigation and daily needs. Farmers then utilize the artesian well made in the middle of farm to irrigate the location (*pantek* wells) using diesel pump engine. Groundwater is pumped using diesel fuel and then filled into artesian wells. The use of artesian wells is intended for better irrigation management because it results in the closer distance of water source to field. Currently, many farmers are switching from diesel fuel to electricity. The diversity of the depth of water results in farming arrangement in this area. There are variations in production cost for the pump machine and the fuel (electricity and diesel).

5.3 Rain-fed Farming

Another water management pattern that has developed in Cepu District is using rain-fed water management. Farmers who use this water management pattern are located in the north of Cepu District, such as in the villages of Tambakromo, Ngroto, Ngelo and Karangboyo. The use of irrigation with this pattern is caused by the condition of the area once most villages are not passed by the Bengawan Solo River, only by small rivers that present little water flow that during the dry season cannot be used at all for irrigation.

Groundwater sources are also unmanageable because the water sources are too deep so that groundwater extraction and utilization is not possible. This situation forces farmers to rely on the only source of water, namely rainwater as a source of water plus small streams to increase the supply of water needs during the rainy season. Irrigation that relies on rainfed water affects the crop rotation by farmers. Farmers can only plant rice during the rainy season, while during the dry season, the field can only be planted with secondary crops and even be fallowed for two consecutive seasons.

5.4 Community-based Irrigation Management in Cepu District, Blora

In line with the dynamics of the community that is formed on the basis of the similarity of conditions and needs of water resources for agricultural land, it is often necessary to produce governance and form an institution to regulate the relationship between individuals in it. Institutionalization can occur in the form

of institutions or organizations, and it can be formal or informal as a guide to regulate the behavior of all members of the community (HANAFIE, 2010). Institutions are not only organs or inanimate objects that can be moved or managed according to the wishes of their managers, but institutions are also related to patterns of behavior, legal rules or norms, principles and ethics, as well as morals and systems that can be influenced by various factors.

Participatory management for common pool resource has been promoted by government with the purpose that users of natural resources can manage it effectively, reducing financial burden to the government. In the longer term, the participatory natural resource management such as participatory irrigation management can bring positive impacts and empower the community.

Based on the interviews conducted with farmers next to Bengawan Solo River, the management of water sourced from the river requires the community to think the effective ways to utilize water from the river, which has a very high-water debit. The first version of joint irrigation management was in the form of institution named "*ulu-ulu"*. The massive use of technical irrigation with water from the Bengawan River by farmers in Cepu began at the era of the Green Revolution in early 1970s. The local community formed a village-level institution to establish a partnership with an irrigation provider company namely PT Dewi Sri. The group was formed based on the interaction between farmers that arose due to the similarity of interests and the same need for the availability and accessibility of irrigation.

The established village group provided positive impacts for the farmers and provided employment opportunities for landless. The landless get the opportunity to work as water distribution officer so they can receive wages from this work. In early 1908s, *ulu-ulu* was modified and terminologically changed to Dharma Tirta Water Use Association. However, the company that supported WUA in Cepu experienced a setback and had to be closed in 1980s, so that the community had to look for other supports and fundings to maintain the irrigation.

The demands from irrigation needs make the community automatically prioritize togetherness to continue to get access to irrigation. The organization that was formed due to a partnership with an irrigation provider company continued its existence and turned into the Water User Association. The institution still exists because farmers need WUA to effectively access irrigation. Farmers will find it difficult to access irrigation infrastructure and water resource on their own because irrigation facilities are not easily accessible to individual, and the maintenance costs are high if it is done individually. The WUA facilitates farmers managing water through primary, secondary and tertiary irrigation canal, proposing funding for procurements or maintenances of irrigation facilities, and implementing norms for joint irrigation management. This is also supported by the role of village officials, who the majority are users and managers of WUA, relaxing the administrative process of the WUA. The existence of WUA cannot be separated from the role of agricultural extension workers who have role as facilitator and communicator in irrigation management (MAULIDA; AULIYA, 2021).

However, in recent years due to climate change, the debit of the Bengawan Solo River is no longer as high as it used to be. The climate change has made farmers in Java facing severe drought and uncertainty (MAULIDA; WATI; SUBEJO, 2022). In Cepu district, water pumped into irrigation canal often has been insufficient to meet the needs of farmers. As a result, some farmers choose to have their own smaller electric pumps either sourced from rivers or

groundwater to water their field. Unfortunately, the dynamo pump of the WUA has been damaged for two years, resulting in some farmers using private pump for back-up plan. Farmers saw that private ownership of the pump was a preventive action and adaptive effort from the adverse effects of climate change and water scarcity.

Different things happened to the group of farmers who are geographically located afar from Bengawan Solo River (Western Cepu). Based on the interview, a formal institution that plays a role in the participatory irrigation management process was not found. Communities in Western Cepu (geographically located in west side of railway tend to manage water sources by individually utilizing groundwater. Farmers are independently drilling artesian wells with diesel-fuelled engines or electrical submersible pumps. Some farmers who have not been able to make individual well, had to pay to access water from farmers who own wells and flow it to their field.

Farmers who manage groundwater irrigation do not initiate the existence of institutions because of difficulties in coordinating water distribution, the collective irrigation management are characterized as small groups within same location, sporadic and the norms attached to these groups are not structured. Irrigation management with submersible pump wells will be more difficult to manage collectively, because it is difficult to split electricity bills according to the electricity use of each individual. Collective irrigation management for this condition is more difficult to regulate among farmers and has the potential to cause unequal distribution of water if managed by a larger group. However, the use of electric fuel can reduce production costs when compared to diesel and save on transportation costs because farmers do not have to go to buy diesel fuel.

In the area where farmers perform rain-fed farming, formal institutions for water management are not established in communities. The area which scarce water sources have impacted in the low motivation for water management, both individually and collectively. Institutions that exist are only limited to farmer groups, which can generally be found in other farming community groups. However, recently some farmers has been promoted to do rain harvesting by agriculture extension workers as an adaptation measure for the water scarcity In harvesting rain, farmers will need ponds or infiltration wells that are managed in groups or by farmer groups. On the other hand, some villages does not have permanent dams and infiltration wells so that the rain harvest is not being optimized. In the future, fundings for infrastructure and training may be needed to implement this alternative.

From the interviewes and FGDs, we identify that WUAs have more access to funding and assistance related to water and irrigation. With better access to irrigation infrastructure and water, farmers that are included in WUAs can produce food three up to four times per year (two times for paddy and one up to two times for horticulture products). Geographically, farmers nearby Bengawan Solo River are privileged with more than three time of cropping seasons, compared to those who performed groundwater irrigation using wells and rainfed farming. However, with better irrigation infrastructure and access to fundings, WUA members are better off, even further studies may be needed for exploring the income and productivity of WUA members.

A classic work by Olson (1965) on Logic of Collective Action provide relevant idea even for the modern agrarian community in managing natural resources. The idea mentioned by Olson was that collective action through groups used by community to share cost and increase benefit

for their economic activities. Even though the costs and benefits are affected by group size and the nature of the interests that characterize the institution, the purpose of the collective action is for maximizing profit.

The formation of irrigation management groups is useful as a means of uniting individuals who have the same interests so that they reduce production costs, maximizing profit, and prevent conflicts between individuals. Apart from being a space for sharing aspirations and information exchange, institution or organization such as WUA can be used as a means of preventing conflicts that arise and promote more sustainable common pool or water management. More efficient water management can prevent damage to the ecological system which causes farmers to no longer be able to use water resources (*Tragedy of the Commons*).

Differences in irrigation patterns formed due to geographical characteristics show different patterns of social interaction between these irrigation patterns. Social relations that exist in an area (geography) based on locality and community engagement strengthen the existence of a community. One of the interesting aspects raised from the interaction pattern of the agrarian community in Cepu District is how the farmers collect information related to irrigation.

Currently, with limited funding in technical training, specifically about water management in Cepu District, information are mainly gathered through information exchange among farmers and communication with agriculture extension workers in farmers' meeting. Farming communities in Cepu sub-district seek information on the most feasible irrigation management on their farms. Farmers seek information on which irrigation management is the most effective and efficient to do by considering aspects such as geographical conditions and water availability, production risks, commodities to be cultivated and the financial capacity of the farming families.

Farmers obtain information about irrigation management in several ways. There are two patterns of interaction that occur in the process of extracting information, namely horizontally (between farmers) and vertically (farmers seeking information from extension workers). In the horizontal pattern, one of the ways that is most often done is through conversations between farmers who have the same geographical conditions and water availability. This method is considered the easiest because interactions between farmers with the same condition of water availability occur more often, especially if the locations of agricultural land are close together. Conversations between farmers also occur through social media applications. Interaction through social media is not only carried out between farmers with similar geographical conditions, but also between farmers with different geographical conditions and other farmers outside the Cepu District area. In the vertical pattern, the method used by farmers to find information about irrigation is by asking their respective field extension workers. However, this method is only considered effective if the extension workers have close relationship with their farmers.

Another way that farmers do to obtain irrigation technical information is through the use of search engines on the internet. Searching for information through this method is mostly done by farmers who are already technology literate. The credibility of the information on the internet is sometimes neglected by farmers, so many farmers believe in information unclear sources which sometimes give them wrong information.

The information that is seek by farmers varying from the use of fuel for irrigation machines, types of machines, sizes of irrigation pipes or networks, ranges of

production costs for irrigation, collective irrigation management systems, to the selection of cropping patterns. One of the impacts of the exchange of information between farmers is the change in the use of diesel fuel pump engines to electric pumps and dynamos which are developing in the Cepu community.

5.5 The Roles of Water Use Association

From the interviews with farmers, patterns of social interaction between farmers can lead to mutual cooperation. Cooperation *(Gotong Royong)* arise because of the concern for achieving common goals and maintain good reciprocal relationships between farmers. The commitment of performing mutual cooperation to improve the quality and quantity of irrigation is not only influenced by strong interaction between fellow irrigation managers of the same irrigational type but can also be strengthened by the availability of irrigation assistance programs by the government. Farmers in Getas Village, for example, do mutual cooperation to accelerate the completion of secondary irrigation networks. After applying for assistance to the local government in 2017, in 2020, Getas Village received fund from the district government for the procurement of pumps, irrigation buildings and for repairing irrigation networks. In order to speed up the completion of network construction, all farm holder in Getas Village who are members of Water Use Association (WUA) work together so that the benefits of this program can be immediately accessed by farmers.

The phenomenon associated with the benefit enjoyed by the farmers is related to the role of the WUA as an organization in creating dynamics in irrigational management. Table 1 shows the role of WUA as a manifestation of collective action performed by farmers in managing water resources. We conduct surveys and quantify the roles of WUA. The total average of role of WUA is 74,56% which indicates the role of WUA is high in water management. The result also indicates that WUA plays significant role in disseminating the perception among farmers that better irrigational system results in higher income (95%). Another benefit in becoming WUA members is the opportunities for information-exchange between members (90%). Information-exchange among farmers leads to improved awareness and knowledge for all of the technologies addressing informational constraints to adoption of agricultural technologies (SHIKUKU, 2019). Besides promoting the communication among farmers, WUA also facilitates farmers to connect to experts such as consultants and extension agents (84%) which increase the chance for technological adoption and increasing income (MUILERMAN; WIGBOLDUS; LEEUWIS, 2018).

Table 1. The Role of Water Use Association (WUA) in Irrigation Management

No.	Roles	Interval Score	Average Score	Percentage
1	Conducting routine meetings for irrigation management	0 – 2	1.70	88.50
2	Communication with experts (extension workers, consultants, etc)	0 – 5	4.20	84.00
3	Communication with local government	0 – 3	1.89	63.00
4	Persuading members to advance irrigation infrastructure and technologies	0 – 5	3.94	78.80
5	Persuading farmers that better irrigation management link with higher productivity	0 – 4	3.80	95.00
6	Facilitating access to financial supports for irrigation infrastructure	0 – 3	1.86	62.00
7	Facilitating members to access credit for irrigation management	0 – 6	1.80	30.00
8	Facilitating access to agricultural inputs	0 – 5	3.77	75.40
9	Information-exchange between members	0 – 2	1.80	90.00
10	Promoting participatory process of decision making	0 – 3	1.80	60.00
11	Promoting cooperation (*gotong royong)* among farmers	0 – 4	3.74	93.50
	Total	**0 – 42**	**28.60**	
	Average			**74.56**

Another notable finding shows that participating at WUA promotes the cooperation or *gotong royong* among farmers (93,5%). This study also found that there is a norm that serves as a benchmark for farmers' behaviour that every farmer whose village receives funds or assistance related to irrigation must participate in mutual cooperation and WUA activities, such as canal checking, canal cleaning, and pump maintenance. When a farmer participates in the *gotong royong* or mutual cooperation frequently, he or she will be categorized as "good farmer", showing image that he or she is selfless and loyal to the community. Although harmony and the spirit of mutual help arise as a result of irrigation development, farmers who participate in mutual cooperation are mostly the landowners. Landless farmers who do not own land tend to withdraw from *gotong royong* activities to accelerate irrigation development because they do not get the benefits of the irrigation infrastructure and mechanisms.

Farmers that are included in WUAs can harvest three up to four times per year (two times for paddy and one up to two times for horticulture products. On the other hand, farmers who do not included as WUA members may only harvest two up to three times per year. The WUA facilitates farmers managing water through primary, secondary and tertiary irrigation canal. Through WUA, farmers can propose fundings for procurements or maintenances of irrigation infrastructures. WUA also provides platform for producing norms and governance for joint irrigation management for better income while information exchange can appear within WUA members. WUA also

promote mutual cooperation (*gotong royong).*

6 CONCLUSION

There are three patterns of small-scale water resource management in Cepu District, namely surface water irrigation patterns using water from the Bengawan Solo River; groundwater irrigation; and rain-fed farming. Water management in watershed areas requires a more complex organization, while the other two geographical locations tend to rely on the ability of individuals to manage water. For the WUA members, the social interaction that occurs among members also helps the development of water resource governance in the Cepu sub-district, this process also encourages the adaptation process of the community to climate change. The activities that involve the management of common resource like irrigation activities count social interaction. The social interaction will enhance harmony and mutual help environment among farmers, produce social innovation such as community-based governance and promote social learning among Water Use Association.

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