

Pentahelix Implementation Based on “KISS” (Collaboration, Integration, Synchronization, and Synergy) in Local Policy on Flood Management Strategy of the Bodri Kuto River Basin

SR. Eko Yuniyanto¹, Ignatius Sriyana², Suharyanto²

Universitas Diponegoro, Indonesia

Abstract

Collaboration, integration, synchronization and synergy approaches in water resources management offer more diverse water resources management efforts in order to deal with flood disaster issues at Bodri Kuto River Basin. The pentahelix-based approach is very relevant and important to adopt on the Bodri Kuto River Basin. This research updates previous research through a combination of river area management approaches based on collaboration, integration, synchronization and synergy among pentahelix stakeholder elements in the Bodri Kuto river area. Research questions asked in this study are: What is the role of each Pentahelix stakeholder in flood management, What is the level of implementation of Collaborative Integration, Synchronization and Synergy between Pentahelix stakeholders in influencing flood management, and What is the flood management strategy for each element of Pentahelix in supporting sustainable development. The purpose of this study is to identify stakeholders in the pentahelix elements, determine the impact of the KISS variables in flood management strategies, and determine priority strategies in flood management on the Bodri Kuto River Basin. Pentahelix stakeholders in flood management at Bodri Kuto River Basin consist of parties from the government, private sectors, academics, non-governmental organizations, and the mass media. Based on the results of the KISS index analysis, it is known that the synchronization variable score is included in the "good" criteria while the other three variables are included in the "average" criteria. These results come in with some concerns and recommendations that the WS Bodri Kuto flood management needs to implement several strategies to increase the KISS variables and short and long-term response strategies based on the SWOT component.

Keywords : KISS variables, flood management, Bodri Kuto River Basin, stakeholders

INTRODUCTION

The Indonesian state constitution already regulates the management of water resources, however the level of public awareness is still at a low level in respecting water resources. The

philosophy of managing water resources according to the substance of Law No. 17 of 2019 consists of 3 pillars, namely Conservation of Water Resources, Utilization of Water Resources and Control of destructive water forces based on community participation and monitoring and support of water resources information systems.

*Correspondence:

Universitas Diponegoro , Indonesia

Email: eko.okesmg@gmail.com

The condition of the river basin and the watersheds within it shall represent the efforts that have been formed in the management of water resources (Paimin et al., 2012). When the dry season comes, it causes the region to suffer a prolonged drought and has an impact on various aspects of the community's lives (Marfai & Mardiatno, 2010; Mawardi, 2010). Entering the rainy season similar problems arise, even though the impacts are different compared to the dry season, in the actual substance both of them cause problems (Budiati, 2012; Paimin et al., 2012). Erdogan (2013) states that a decrease in the quality of the environment in the watershed indicates that the level of health of the watershed is decreasing, it can be identified where if frequent floods occur during the rainy season, and during the dry season the region experiences a shortage of clean water, erosion, sedimentation and a decrease in water quality. Floods have a continuous impact, ranging from damage to infrastructure, crop failure, and other economic losses (Asrofi et al., 2017; Erlani & Nugrahandika, 2019; Hartini et al., 2015; Mawardi, 2010; Pitanggi et al., 2017; Rosyidie, 2013).

Based on previous researchs, there have been many studies that have examined flood or water resources management, however this research wants to show that each region has its own characteristics on this topic. In addition, not many of them apply the pentahelix approach in it. Research conducted by Sudaryono (2002) emphasizes that the watershed management planning process must involve as much as possible affected

stakeholders, existing local, regional and national issues. However, this research has not used the pentahelix stakeholder approach to show the role of each stakeholder.

Another study by Santoso (2013) showed that in the management of watersheds, institutional aspects play an important role, especially in the implementation of land acquisition, control of spatial use, and budgeting. Santoso believes that watershed management requires a pattern of collaboration among existing stakeholders. So the renewal of the research, this study uses an approach not only collaboration but also elements of integration, synchronization, and synergy.

This research also develops research conducted by Sriyana (2018) entitled Index of Stakeholders in Watershed Management with the KISS Approach in Indonesia. Based on Sriyana's research, this research applies the KISS analysis method to a more local scope in Central Java Province, specifically in the Bodri Kuto river basin. The characteristics of the management of the Bodri Kuto River basin can indicate the level of flood management under certain stakeholder conditions.

In general, data shows that the flooded areas are increasing from year to year in Central Java (Bappeda Provinsi Jawa Tengah, 2017a, 2017b; BMKG Stasiun Klimatologi Semarang, 2019). In 2018 the floods inundated rice fields were only 2,183 Ha, in 2020 it increased to 4,895 Ha, while the frequency of flood events was 212 in 2013 increased to 270 times in 2017 (BPBD Provinsi Jawa Tengah, 2017). The flooded area occupies

20.91% of the Central Java region with high fluctuation rates considering the sensitivity to watershed responses due to heterogenous variable activities within the watershed and the influence of global natural phenomena.

The Bodri Kuto River Basin as a river area which is under the authority of Central Java Province encounters various challenges in the form of floods, droughts, sedimentation and landslides (Fauzia, Setiadi and Nugraha, 2019; Fauzia *et al.*, 2021). The river basin which consists of 12 watersheds also has a diverse topography for example mountains, highlands, transitional areas, lowlands and coastal areas. The upstream of the Bodri Kuto watershed is located in the districts of Temanggung and Batang, therefore conservation aspects need to be considered in these two areas. Aspects of water utilization and control of destructive water force demand to get more concern in coastal areas considering the high number of activities and population density. Therefore, the management of water resources in the Bodri Kuto River Basin requires identifying problems, paying attention to strategic issues at both the local and national levels, and accommodating the stakeholders involved according to their respective roles. The approach of collaboration, integration, synchronization, and synergy of pentahelix-based water resources management is very interrelated and important to be adopted in the Bodri Kuto River Basin.

LITERATURE REVIEW

The definition of a river area is a scope of water resources management

area in one or more river basins and/or small islands which has an area requirement of less than or equal to 2,000 km² in accordance to PUPR Ministerial Regulation Number 4/PRT/M/2015.

The river areas in Central Java Province consist of 2 national strategic river areas, 6 river areas across districts/cities, and 2 river areas within districts. These river areas have a lot of diversity, including the total area of the river area, population, socio-economic activities, climatic and hydrological conditions, water users, water utilization levels, and river area management institutions. Due to the variety of conditions, the management of one river area is different from another.

A river basin (DAS) is an area whose function is to contain, store and channel rainfall to a main river that has an outlet into the sea or lake and is limited by topographical boundaries. Topographic boundaries can be in the form of ridges and bottom dividers in the form of rocks. A watershed shows the interrelationship between various components and also the dependence between various components of the ecosystem and between all sections from upstream to downstream (Government Regulation of the Republic of Indonesia No. 37, 2012).

Asdak (2010) said that the watershed ecosystem is divided into three sections, namely upstream, middle and downstream. The definition of an upstream area is a conservation area, with several criteria such as high drainage density, slope level greater than 15%, not a flood area, drainage patterns regulating water use, and forest stands as a type of vegetation. Second,

the downstream watershed area is a cultivation area that has an average slope level of less than 8%, in the form of flood areas in several locations, the allocation of water use depends on irrigation buildings, and people's gardens are the main type of crop. Finally, the meaning of the middle watershed is a transition area between the two biogeophysical characteristics of the upstream and downstream areas. A watershed as an ecosystem means the location of the biophysical environment, organismal elements, and chemical elements that interact dynamically with each other and the flow in and out of materials and there is a balance of energy within it.

Nowadays, watershed ecosystems are under pressure caused by increasing human population and the phenomenon of climate change (Lalika et al., 2015). A large population requires more space, which causes uncontrolled land use changes and has negative impacts on the environment (Kundu et al., 2017; Zhang et al., 2010). This has led to complex institutional challenges for water management (Msuya & Lalika, 2017). Furthermore, river watersheds have been degraded in their function as sustainable water providers (de Groot et al., 2010; Lalika et al., 2015).

Watershed management can generally be defined as the activity of regulating/ managing renewable natural resources with the aim of improving, maintaining and protecting watersheds in order to produce water resources that provide benefits for human interests (Manan, 1976).

Watershed management is a concept of utilization and protection of

natural resources that involves various parties/interests including government institutions, the private sector and the community (Fatahillah, 2013). Watershed management requires active participation from stakeholders in utilizing natural resources. Active participation from various interested stakeholders aims to minimize the impacts emerging from the development process.

An inclusive framework in watershed management focuses on efforts to create healthy and sustainable watersheds, as well as gaining benefits from the existence of these watersheds. Watershed governance further emphasizes benefits for society based on a collaborative process which includes the development of common goals, growing trust between stakeholders who have conflicting interests, as well as sustainable and better use of resources based on accurate information (Frankset al., 2011). A key factor for successful watershed governance is increasing collaboration and connections between local communities and decision makers at the watershed scale (Lalika et al., 2015). In order to manage watersheds, a new paradigm is needed (Nugroho, 2003), namely: integrated collaboration between sectors, high levels of community participation, increasing community capacity, increasing institutional capacity and incentives for local communities around the watershed area.

As a solution to the problem of multiple parties, the penta helix model is very useful because stakeholders have different interests based on their origin (Sturesson, Lindmark, and Roos, 2009).

The hope of stakeholder cooperation is to create policies that are supported by synergistic interaction of resources.

The theory behind the pentahelix concept is the triple helix theory, which means there are 3 stakeholders, namely the government, entrepreneurs and academics and the quadra helix theory, where there are 4 stakeholders involved, including other stakeholders, namely the community. In the penta helix concept, mass media completes the number of stakeholders into five.

The penta helix illustrates the difference between stakeholders who are more business oriented. Stakeholders from the business world are usually competitive, aggressive, ready to take risks and also ready to experience failure. The penta helix is a cutting-edge concept, considered a great tool for working in complex and economic environments, compared to discussions of innovation by the user/market based business world.

METHODOLOGY

Study Area

The scope of research for this area at a macro level is Central Java Province, regardless, this research specifically inspects the attributes of water resource

management in the Bodri Kuto River Basin. The Bodri-Kuto River area has an area of $\pm 1645.91 \text{ Km}^2$, divided into 12 watersheds (Brontak, Kedondong, Pesanggrahan, Kuto, Damar, Bulangan, Blukar, Bodri, Buntu, Kendal, Blorong and Glagah Waridin) located in a geographical position between $6^{\circ}49'44'' - 6^{\circ}49'47''$ South Latitude and $109^{\circ}49'20'' - 110^{\circ}21'59''$ East Longitude, covering the administrative area of Kendal Regency, part of the administrative area of Batang Regency, Semarang City, Semarang Regency, and Temanggung Regency.

Variables, Population and Sample

The research applied two types of data, primary data together with secondary data. Primary data is data originally direct from the observation area, while secondary data is data that comes from the literature, for instance, books, researchs, activity reports, maps, or other data obtained from official sources/agencies. Primary data acquisition via in-depth interviews with relevant stakeholders (pentahelix elements) as well as direct field observations with visual documentation. Obtaining secondary data by means of reviewing previous documents at official agencies or sources (pentahelix elements).

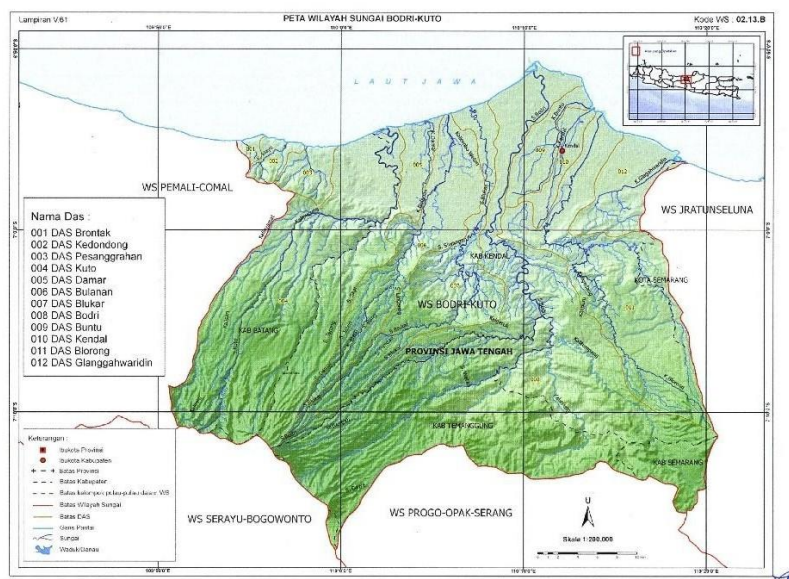


Figure 1. Map of the BODRI KUTO River Basin

Source: Central Java Governor Regulation No. 52/2019

The selection of respondents applied a purposive sampling technique, where the sample/respondent was the intention of the researcher according to the interests of the researcher. Arikunto (2013) argues that sampling with purposive sampling pays attention to certain objectives and considerations where the sample has certain characteristics, traits and characteristics. The selection of respondents was based on the principle of representativeness in their respective fields or institutions. The number of samples is not too much, the most important thing is to represent the research target institution/agencies.

METHOD

This descriptive research used qualitative and quantitative approaches. A qualitative approach is an approach in conducting research that is oriented towards natural phenomena, so research has naturalistic and basic characteristics or is natural and cannot be applied in the

laboratory but must be carried out in the field. While the quantitative approach is one of the scientific search efforts based on the philosophy of logical positivism which operates with strict rules regarding logic, truth, laws and predictions.

Identification of stakeholders by reviewing secondary documents focuses on the main functions of government parties involved in the implementation of water resources management. The process of searching for primary data by conducting in-depth interviews with the main respondents along with the supporting documents obtained. Pentahelix components must be represented in identifying stakeholders, each element has different levels of diversity but all of these elements have a close relationship (task, location, interests) related to the management of water resources in the Bodri Kuto River Basin.

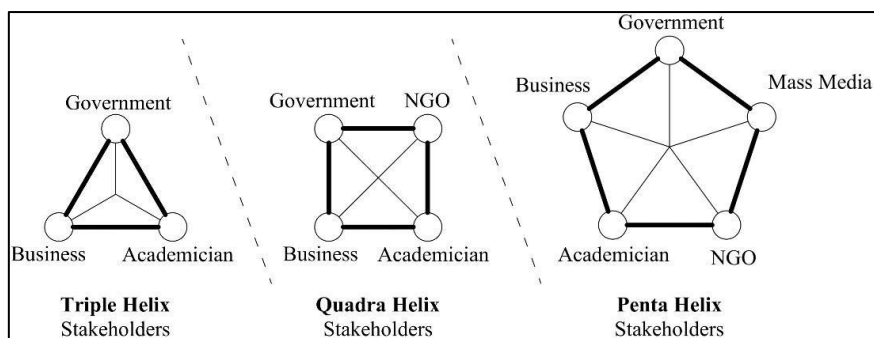


Figure 2 Stakeholders of Triple Helix, Quadra Helix and Penta Helix

Source: Results of Theory Analysis from Various Sources

Research also used questionnaires as a tool for conducting index analysis. Index analysis was performed by analyzing data quality tests from the results of the questionnaires distributed. Through the validity test and reliability test, the average value of each variable and indicator was calculated using a descriptive index number method.

Research evaluated the strengths, weaknesses, opportunities and threats of WS Bodri Kuto using the SWOT analysis method. Rangkuti (Rangkuti, 2006) explains that SWOT analysis is a systematic identification of various factors to formulate problem solving strategies. The basic considerations employed are the internal environment and the external environment. The internal environment consists of aspects of strengths and weaknesses, while the external environment consists of aspects of opportunities and threats.

RESULTS

Based on existing conditions, the pattern of water resource management in the Bodri Kuto River Basin focuses largely on Kendal Regency. However, considering that the upstream area of the Bodri Kuto River Basin is in Temanggung and Batang Regencies, the

conservation aspect needs to be considered in these two regions. The increase in the number of flood events from year to year in the Bodri Kuto River Region from 2010 to 2022 shows that aspects of water utilization and controlling the destructive power of water need to be given more attention in areas where population numbers and density are high. In this research, the elements of the penta helix are used to identify stakeholders involved in flood management, especially in the Bodri Kuto river area. This model will describe the relationships between all parties involved.

Identification of Stakeholder Roles and Functions

The penta helix model was used to identify stakeholders involved in flood management, especially in the Bodri Kuto river area. The collaboration of these 5 (five) stakeholders is expected to be able to realize a policy that is supported by a variety of resources that interact synergistically with each other.

Government stakeholders pose at several levels of government starting from the national, provincial, district/city, sub-district to the village levels as well as elements from the TNI/POLRI. The main stakeholder in the

national government side is the Pemali Juana River Basin Center (BBWS) as a technical implementing unit in the field of water resource conservation, water resource development, utilization of water resources and controlling the destructive water forces in river basins.

Stakeholders from the private sector in the form of community

interests depend on how the flood will affect them, whether it provides an opportunity to grow their business or obstruction to their future development. This group has potential in terms of funding (in the form of corporate social responsibility). Several big companies exist in this area, especially

Table 1. KISS Index Analysis Results

Variable	Index	Category	Index	Category
	Variable	Variable		
Coordination	45.59	moderate	48	moderate
Integration	47.39	moderate		
Synchronization	51.61	good		
Synergy	47.39	moderate		

(Source: author analysis, 2022)

Kendal Regency as a downstream area that often experiences flooding. The main stakeholders in this group are KEK Kendal, PT Kawasan Industri Seafer, and PT Gudang Garam.

Academic practitioners have relevant knowledge and experience in project/policy development. Apart from locally based practitioners, there are also national and international actors who can contribute their knowledge and experience, such as research organizations, lobbying and advocacy groups or consultants. Members of this group often express strong and relevant opinions on the problem. Universities that play an important role in the Bodri Kuto River Basin are UNDIP, UNISSULA, and Selamat Sri Kendal University.

Non-governmental organizations (Civil Society) established by individuals or groups who voluntarily provide

services to the community without aiming to gain profit from their activities. This group consists of River Care Communities such as OPSI Klampok, Tide Control and Management Group of Panggung Lor Tide, and the Sukorejo Mancing Mancing Community (KMMS), as well as a combination of communities and other community elements in the Bodri DAS Forum.

The last party is the mass media, the actors in this group are all media, digital or not. Their interests will be driven by what is important to be known by the wider community through the media they have.

KISS Index level in flood management

Before carrying out the KISS index analysis, the results of the questionnaire that have been obtained are first tested for the validity and reliability of the variables used in the

KISS index analysis. The validity of each item is shown by the total column. Based on the *r* table, the minimum Pearson Correlation value is 0.279 because it uses 50 respondents (N) with a limit of 0.05. Meanwhile, reliability is carried out by calculating the Cronbach alpha coefficient for each instrument in a variable. An instrument can be said to be reliable if it has a Cronbach alpha coefficient of more than 0.60 (Ghozali, 2006: 42).

Based on the results of validity and reliability tests for each variable obtained using the SPSS program, the results are as follows:

Based on the results of the KISS index analysis, it was known that the synchronization variable produced the "good" criteria while the other three variables were included in the "moderate" criteria.

Collaboration variable, all indicators are included in the "medium" criteria. The seven indicators are the preparation of flood disaster management documents/ contingency plans/SOP involve multiple relevant parties, flood disaster management activities in the agency refer to disaster management documents, in flood disaster management incidental meetings are held with other relevant agencies, in flood disaster management scheduled meetings are held with other relevant agencies, in flood disaster management, meetings are held with relevant community groups, in determining flood disaster management, input from the community is adequately accommodated, and the results of monitoring and evaluation for flood

disaster management are coordinated with relevant agencies.

In the integration variable, there are two indicators that included into the "good" criteria, namely the preparation of documents for flood disaster management/contingency plans/SOP that have integrated multi-party programs proportionally and for flood disaster management that there has been an agreement on the division of work areas with other relevant parties/institutions proportionally. The other four indicators are included in the "medium" criteria.

The results show that all indicators of the synchronization variable fall into the "good" criteria. The six indicators are that the preparation of flood disaster management documents/contingency plans/SOP has adjusted to the time of program/activity implementation, flood disaster management documents/ contingency plans/ SOP have been based on data from multiple relevant parties, implementation of contingency plan activities/SOP has been in accordance with time implementation of activities by multiple parties, implementation of flood disaster management activities has clear sectoral targets and objectives, implementation of flood disaster management activities has proportional cross-sectoral targets and objectives, and implementation of flood disaster management monitoring and evaluation activities is in accordance with the program of each agency.

For the synergy variable, there are two indicators that are included in the "good" criteria, namely the preparation of flood disaster management

documents/ contingency plans/SOP that reflect the joint agreement of multi-parties and the implementation of flood disaster management activities that are oriented towards goals that are adaptive to dynamic changes in conditions and also according to regional conditions. Meanwhile, the other four indicators are included in the "medium" criteria.

This shows that flood prevention activities and documents already have achievement targets and involve the relevant multi-stakeholders when preparing and implementing them.

The influence of KISS variables in flood management strategies

The SWOT matrix analysis results revealed the interaction between internal and external factors in flood management in the Bodri Kuto River Basin. The results of the strategy formulation based on the identification of internal and external factors in the KISS variable for flood management in the Bodri Kuto River Basin were translated into four strategies as follows:

1) Strength (S) and Opportunity (O) Strategies

These strategies are produced by combining advantages from internal and external aspects through exploiting the strengths of identified opportunities. The S-O strategies in flood management in the Bodri Kuto River Area are formulated as follows:

- Preparation of documents for flood disaster management/SOP based on mutual agreement between stakeholders, which should accommodate data from multiple parties to produce programs for stakeholders proportionally according to the target.

- Organize scheduled and incidental meetings with stakeholders to accommodate information/data from multiple parties and synchronize schedules and targets to be achieved.
- Enhancing cooperation and conducting integrated monitoring and evaluation together with stakeholders

2) Weaknesses (W) and Opportunities (O) Strategies

These strategies are produced by combining internal aspects of Weaknesses and external Opportunities through exploiting opportunities that have been identified and reducing existing weaknesses. The W-O strategies for flood management in the Bodri Kuto River Area are formulated as follows:

- Organizing meetings with the community to collect and accommodate recommendations and information
- Implementation of monitoring and evaluation of multi-sector activity schedules and targets
- Increasing cooperation in formulating adaptation activities to follow up on dynamic conditions

3) Strengths (S) and Threats (T) Strategies

These strategies are produced by combining internal aspects of Strength and external Threats through utilizing identified strengths and reducing existing threats. S-T strategies in flood management in the Bodri Kuto River Area are formulated as follows:

- Identify and further involve relevant stakeholders so that no actor is excluded.

- Periodic monitoring and evaluation in accordance with each program and supported by good reporting become the substance of collaborative evaluation.
- Compilation of goal-oriented programs and activities for flood disaster management/SOP that are adaptive to dynamic conditions in accordance with regional conditions.

4) Weaknesses (W) and Threats (T) Strategies

These strategies are produced by combining internal aspects of weaknesses and external threats by improving identified weaknesses and reducing existing threats. W-T strategies in flood management in the Bodri Kuto River Area are formulated as follows:

- Involvement and accommodation of relevant multi-stakeholder roles in all aspects of flood management
- Preparation of flood management documents that clearly state the proportional allocation of duties and financing
- Review and revision of flood management documents/SOPs that are more adaptive to dynamic conditions

CONCLUSIONS

Existing conditions in the Bodri Kuto River Basin show that flooding problems in the region are related to inadequate management in terms of collaboration, integration, synchronization and synergy approaches between stakeholders from the pentahelix elements. The results of studies conducted on stakeholder

components and KISS levels in flood management at the Bodri Kuto Watershed yielded the following results:

KISS Variables Improvement Strategies

The indicators included in the 'moderate' category in the Collaboration variable are closely related to stakeholder identification and how the pentahelix approach works. Engagement and communication with relevant multi-stakeholders as well as incidental and scheduled meetings with multi-stakeholders will be easier to apply if stakeholders included in the pentahelix have been identified.

The need for various programs and the need for a large budget to deal with flooding in the Bodri Kuto River Basin should be supported by the active role of relevant stakeholders, according to their respective duties and roles. The right strategy is to form a mutual agreement between stakeholders through the implementation of coordination meetings at each stage of the flood management process. In addition, periodic evaluation of flood management performance was conducted with the involvement of pentahelix stakeholders in flood management at Bodri Kuto river basin. Furthermore, to increase integration variables, monitoring and evaluation become important tools to measure the level of integration.

In managing ideas from the community, it is more useful to assemble groupings that symbolize the representation of each element of society. An example is the grouping of people from the upstream, middle, and downstream areas of a river area

because they encounter flood problems with different characteristics.

Action prioritization strategy

Paying attention to the results of the KISS index analysis, it can be seen which variables need more attention in order to increase their value so that they attain a good index that supports each of the main variables, namely Collaboration, Integration, Synchronization and Synergy. Furthermore, through the results of the SWOT analysis, several strategies emerged that can be used to support the increase in the KISS variable index and also produce strategies for the short and long term in managing floods in the Bodri Kuto River Basin.

The short-term flood management strategies for Bodri Kuto river basin are as follows:

- 1) Identification and further involvement of relevant multistakeholders so that no one is excluded
- 2) Review and revision of flood management documents (SOP) that are more adaptive to dynamic conditions.
- 3) Organizing meetings with key pentahelix stakeholders to collect and accommodate information and recommendations
- 4) Implementation of monitoring and evaluation of multi-sector action schedules and targets

The long-term management strategies for Bodri Kuto River Basin flood management are as follows:

- 1) Preparation of documents for flood disaster management (SOP) based on mutual agreement between stakeholders, which should

accommodate data from multiple parties to produce programs for stakeholders proportionally according to the target.

- 2) Establishment of Bodri Kuto River Basin management institution with the aim that the planning and implementation of water resources management in Bodri Kuto River Basin is more well structured and there are no overlapping policies
- 3) Periodic monitoring and evaluation in accordance with each program and supported by good reporting become the substance of the collaborative evaluation.

RECOMMENDATIONS

Based on research conclusions, several recommendations that we can convey in the context of flood management in the Bodri Kutho river basin are as follows:

Pentahelix key stakeholders who have an important role, can encourage other actors who have not contributed optimally to escalate their contribution. For instance, the Government can encourage the mass media to always provide relevant information regarding flooding to the public, through particular events in audio-visual media, special columns in mass and electronic media as well as public service advertisements related to flood anticipation and prevention efforts.

Second, the standard operating procedure Document for Flood Events becomes highly strategic in efforts to deal with floods, therefore, the process of preparing this document as well as updating the measures for anticipating

and handling floods should be consistently considered.

Third, it is necessary to improve the coordination, integration, and synergy variables immediately because, based on the results of the index assessment, the condition is "moderate." The coordination forums between pentahelix stakeholders need to be maintained regularly, not only when a flood occurs. Measures to prevent flooding must be emphasized.

Fourth, in order to support further research, it is necessary to study the types and calculation of the KISS index variable in the Bodri Kuto River Basin which can become a standard reference for other river basins. Finally, it is necessary to consider the establishment of an institution with special authority in the management of WS Bodri Kuto.

This research shows support for previous research which reveals the strategic role of stakeholders in water resource management efforts. The pentahelix study can be applied to other river basins with different management characteristics and stakeholders.

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