SCIENTIFIC CULTURE
www.sci-cult.com

SCIENTIFIC CULTURE, Vol. 12, No. 1.1, (2026), pp. 712-718
Open Access. Online & Print

DOI: 10.5281/zenodo.11425158

THE ROLE OF STAKEHOLDERS ON INTEGRATED AMBANG WATERSHED MANAGEMENT: IMPLICATIONS FOR FLOOD MITIGATION IN GREATER MALANG

Aptu Andy Kurniawan[1*], Sunardi[1], Hendarmawan[1], Iwan Ridwansyah[2]

[1]Padjadjaran University Bandung, Indonesia, aptu22001@mail.unpad.ac.id, https://orcid.org/0000-0003-0996-7085, sunardi@unpad.ac.id, https://orcid.org/0000-0002-7972-3580, hendarmawan@unpad.ac.id, https://orcid.org/0000-0003-0900-3331

[2]National Research and Innovation Agency, Indonesia, iwanridwansyah@gmail.com https://orcid.org/0000-0002-2553-9390

Received: 11/11/2025
Accepted: 18/12/2025

Corresponding Author: Aptu Andy Kurniawan (aptu22001@mail.inpad.ac.id)

ABSTRACT

Stakeholder play a crucial role in flood mitigation. This study aims to identify the key stakeholders in Ambang watershed for flood mitigation on Greater Malang. We employed Interpretive Structural Modelling (ISM) approach a focus on Greater Malang. In implementing the ISM method, a brainstorming session was first conducted with five experts to gather ideas on the role of stakeholders in flood mitigation in Malang Raya through integrated watershed management. These participants were people who understood the ISM concept, understood the problems of flood mitigation in Malang Raya, and had expertise in watershed management. From the discussion on flood mitigation strategies in Malang Raya, several ideas or variables were obtained that would be processed using ISM. The first step in ISM processing is to create a Structural Self-Interaction Matrix (SSIM), where the variables are contextually related by combining variables i and j. Next, a reachability matrix (RM) is created by converting V, A, X, and O to 1 and 0, respectively. The final step is to create a Canonical Matrix to determine levels through iteration.The results indicate that BBWS Brantas (A1), Balai Brantas Sampean (A2) and Forum DAS Brantas and TKPSDA are the key stakeholder. BBWS Brantas (A1) and Balai Brantas Sampean (A2) are identified as significant stakeholders at Level 1, as shown in the table. Every action performed by these stakeholders will determine the success of the flood control program. Conversely, if these stakeholder elements are not given sufficient attention, it will lead to program failure. At level 2, the watershed forum and the Brantas TKPSDA (A7) serve as a bridge between organizations to develop a shared strategy for managing the Ambang river basin in Malang Raya, specifically addressing flood issues in an integrated and sustainable manner involving important stakeholders. This research complements the literature on stakeholder roles in flood management with empirical evidence on stakeholders who play a significant role in flood management. The results provide practical recommendations for policymakers and for creating programs in integrated watershed management for flood management and maximizing the involvement of key stakeholders.

KEYWORDS: Role of Stakeholder, Flood Vulnerable, Self-Interaction Matrix, Reachability Matrix, Canonical Matrix, Interpretive Structural modelling, Watershed Management, Flood Management.

1. INTRODUCTION

The causes of flood disasters in the Indonesian Disaster Risk Book (IDRB, 2023) include the critical condition of river basins due to reduced infiltration of rainwater into the aquifer system and increased soil erosion, resulting in high sedimentation in channels and estuaries. Inadequate capacity of the flood defense system. Land conversion from vegetation cover to non-vegetation cover in river basins (DAS) is increasing. Changes in the hydrological regime are widely investigated using annual and seasonal flow characteristics based on a probabilistic representation of the seasonal runoff regime at the daily time scale (Borislava et al.,2023). Population growth, coupled with increased development efforts, has led to a change in land use trends in Indonesia. . Land use significantly affected soil degradation, Soil characteristics were soil texture, bulk density, and total porosity (Mujiyo et al.,2021). In 2009, 108 super priority watersheds in Indonesia were critically degraded. The number of damaged super priority watersheds had increased to 46 (Mahmud et al., 2018). The Ambang sub-watershed was identified as a critical super priority watershed. Field observations of successive floods reveal a concerning level of land degradation in the upstream part of the watershed. This degradation can be attributed, at least in part, to inadequate management practices. It is anticipated that there will be a significant increase in flood risk in the future, primarily as a result of climate change (Pit, 2008). When heavy rainfall occurs, along with inadequate drainage and overflowing river banks, it can lead to flooding. This is especially concerning due to the increasing frequency and intensity of extreme weather events. It has been documented that there is an increase in rainfall intensity due to an increase in heavy rainfall (Fowler et al., 2010). Recently, the Eastern Province of Java has been affected by extensive flooding due to heavy rainfall, with the potential for worsening conditions in the future (Isa,2016).

This research aims to assess the factors that influence stakeholder involvement in integrated watershed management for flood prevention in Greater Malang. The analysis was conducted using the ISM Professional 2.0 tool, which uses the Interpretive Structural Modelling (ISM) technique. The ISM Professional 2.0 program, which uses the Interpretive Structural Modelling (ISM) technique, enables the visualisation and exploration of complex stakeholder data. ISM simplifies data by reducing its dimensionality, allowing for better interpretation and communication.

The program also allows for the identification of important stakeholders necessary for the maintenance of flood management. This information is valuable for informing management decisions and flood management strategies. This application is incredibly versatile and can easily be customized to meet the needs of various stakeholders and accommodate different data formats. As a result, it proves to be an invaluable tool for conducting flood management research. This paper's uniqueness stems from the utilization of the ISM programme. Furthermore, the utilization of Interpretive Structural Modelling (ISM) allows for a comprehensive grasp of the elements that impact important stakeholders. This paper offers a fresh outlook on assessing flood control strategies and their effects on integrated watershed management, with a specific focus on the Malang metropolitan area. It offers valuable perspectives on the long-term viability of flood management in a watershed context. The article is organized into four main sections. The initial part is the introduction. This section offers a concise overview of the significance of watershed and flood management. Effective watershed management strategies for flood control necessitate the participation of various stakeholders. The second section provides a detailed description of the study process and outlines the approach utilized to measure important stakeholder attributes through the ISM methodology. In the last section, you'll find the study's results, where the research findings are presented. The study has identified several important stakeholders involved in ensuring the long-term viability of flood management. In the conclusion, the main findings of the study are highlighted, underscoring the significance of taking into account various factors for sustainable flood management. The findings emphasize the importance of involving multiple stakeholders.

2. LITERATURE REVIEW

Floods can have significant impacts on society, both directly and indirectly (Isa et al., 2015). The problem of watershed degradation and land conservation is primarily an institutional issue related to land rights and ineffective interactions between agencies responsible for protecting watershed quality (Kartodihardjo et al., 2004). The term "stakeholder" was initially documented in the 17th century (Reed et al., 2009). A stakeholder is a group or individual within an organization (Gaur, 2013). People, communities, or organizations can be affected by policies or laws that may have an unfair impact on one side when it comes to reducing the risk of flooding (Raman et al., 2015). An activity or policy may have different financial impacts on different parties (Race, 2008). Stakeholders are individuals or groups who have the ability to impact or be impacted by the organization's goals. It could be any type of policy, initiative, or development project. The text states that there are 15 references. All individuals, communities, socio-economic groups, and institutions at various levels and dimensions of society can be seen as stakeholders (Lienert, 2013). Every group possesses valuable resources, and it is crucial to include them all in the decision-making process for development initiatives. Proper decision-making cannot be effectively carried out by a single group (Gonsalves et al., 2005). When it comes to the involvement of stakeholders in the implementation of flood risk reduction, two important factors to consider are their active participation and how they are categorized. Stakeholder interests are categorized based on classification, distinguishing them from supporting, main, and other categories. The stakeholders are the ones who primarily benefit from both the positive and negative impacts of an activity. Supporting stakeholders are the intermediaries that facilitate the execution of activities.According to source (Crosbi, 1991). Supporting stakeholders encompass a wide range of entities, such as government agencies, non governmental organisations (NGOs), the commercial sector, financiers, implementers, regulators, and various others. Ultimately, the stakeholder group is comprised of individuals or significant groups with formal or informal interests. These stakeholders play a crucial role in ensuring the issue is addressed and operations run smoothly. One effective approach to accomplish the goals while conducting the operations is by engaging the stakeholders. It is anticipated that their involvement will lead to the prompt development and execution of an action plan (Iqbal,2007). If there is harmony and cooperation between national and local governments and related institutions within an area, watershed management will work effectively.

3. DATA AND METHODOLOGY

This research was conducted in the sub-watershed Ambang Malang Raya in January-February 2023. Ambang Sub Watershed is geographically located at the coordinates 112°28'37" - 112°58'55" East and. 7°44'28"-8°19'57" LS, administratively located in Batu City, Malang City and Malang Regency of East Java Province. The upstream area is within the administrative area of Batu City government, while the middle area is in Malang City government and the downstream area is in Malang Regency. Ambang Sub Watershed covers an area of 101,675 ha with a length of 77 km, as presented in Figure 1.

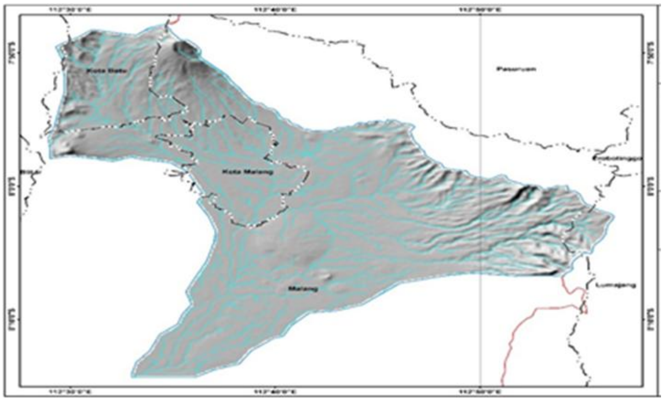


Figure 1: Ambang Sub Watershed Region.

The acquisition of secondary data was accomplished by conducting literature searches of study findings, literature reviews, reports, and records from various pertinent agencies. Primary data is obtained by conducting fieldwork and gathering expert responses through questionnaires. Primary data refers to information that is obtained directly from the original source and recorded for the first time. Seven specialists were interviewed in total (Nasution, 2011). An optimal number of experts falls within the range of 3 to 7 individuals. The study involved the deliberate selection of 5 respondents who met specific criteria: they had knowledge of the subject being studied, were familiar with the research site, held at least a Master's degree in education relevant to the required expertise, and worked as a researcher, practitioner, or relevant government official (Hora, 2004).

The Interpretive Structural Modelling (ISM) approach is employed to analyze the key stakeholders involved in flood control. This analysis is conducted using the ISM Professional 2.0 program. The ISM programme assesses the implementation of forest management methods. The Interpretive Structural Modelling (ISM) technique was first introduced by J. Warfield in 1973. ISM, or Interpretive Structural Modeling, is an effective method for arranging intricate problems (Janes, 1988).

The process of structuring commences by assembling a group of specialists, under the guidance of a facilitator, to engage in brainstorming or conduct a focus group discussion (FGD) in order to capture the viewpoints of the authors. A map is generated to depict the interconnections among variables in an intricate scenario. This approach entails using seasoned professionals with genuine competence to deconstruct a complex system into various subsystems and develop a hierarchical model. The hierarchical model improves comprehension of the components in an intricate scenario and enables the formulation of a strategy to tackle the issue.

Past studies have utilized ISM to discover solutions to a wide range of complex problems. As an observer, utilized ISM and group problem solving techniques to pinpoint the primary obstacles to green technology transfer (Khan et al., 2017). Another study on technology transfer was conducted in China (Shouwu, 2016). It examined the relationship and hierarchy of key factors in international technology transfer through the use of ISM and the Delphi technique. In a different field, conducted semi-structured interviews and used ISM to examine the significant waste variables in office building retrofit projects (Li, 2014). A more recent study has sought to develop an alternative assessment tool for energy efficiency and optimization by combining ISM and Analytical Hierarchical Processing (Attri et al., 2013).

The typical steps of the ISM method are as follows

1. Make sure to include multiple sub-elements for each element.
2. Present paired comparisons to determine if there is a contextual relationship between the sub-components of each element, based on expert opinion.
3. Assign the letters V, A, X and O to the Structural Self Interaction Matrix (SSIM).

In the ISM model, the relationship between the dependent variable and the contextual elements is expressed using the letters V, A, X, and O. It appears that the sub-element ke-i is connected to the sub-element ke-j, while the sub-element ke-j is not connected to sub-element ke-i. There is a relationship between sub-element ke-j and sub-element ke-i, but sub-element ke-i is not reciprocally related to sub-element ke-j.

X: The sub-element ke-i is connected to the sub-element ke-j.

There is no connection between sub-element ke-i and sub-element ke-j.

Connections between sub-elements, represented by a matrix of cells containing letters (VAXO), are converted into a matrix. Working with the reachability matrix, testing and transforming it. Boolean operations need to satisfy reflexive and transitive conditions in order to determine the reachability of a matrix. If not, the program executes recursive multiplication operations to establish a closed matrix condition, resulting in a causal looping. By replacing the symbols V, A, X, and O with the numbers 1 or 0, the Reachability Matrix (RM) table is formed.

The sub-elements are classified according to their respective levels according to specific rules.

a. Make an RM matrix according to the levels of transitivity.
b. Assess the achievability horizontally for sub-elements with a value of 1 to determine the level of each sub-element.
c. Find the antecedent by aligning it vertically with sub-elements that have a value of 1.
d. Think of the intersection as a collection of values that are common to multiple sets.
e. When the reachability and intersection values match, it becomes possible to determine the level of the sub-element.
f. Remove sub-elements with predetermined levels.
g. Repeat the process until the levels of all the sub-elements have been determined. Align the sub-elements within each element either vertically or horizontally.

Arrange the Driver Power Dependence (DPD) matrix for each component. The elements are categorized into four quadrants for classification.

a. Quadrant I,The elements are categorized into four quadrants for classification.rred to as unrelated (autonomous), the sub-elements have a driving power (DP) value that is equal to or less than 0.5 X, along with a dependence value (D) that is equal to or less than 0.5 X. Each element is measured by the number of sub-elements it contains. Sub-elements in quadrant I are usually unrelated or insignificant to the system, just as a data scientist would analyze.
b. Quadrant II, also known as "Not Free (Dependent)", consists of sub-elements that have a Driver Power (DP) value of 0.5 X or lower and a Dependence (D) value of 0.5 X or higher. Each element contains a certain number of sub-elements, denoted by X. Elements in quadrant II rely on the data from elements in quadrant III.
c. Quadrant III. The sub-elements have a driving power (DP) value that is equal to or greater than 0.5 X, along with a dependency (D) value

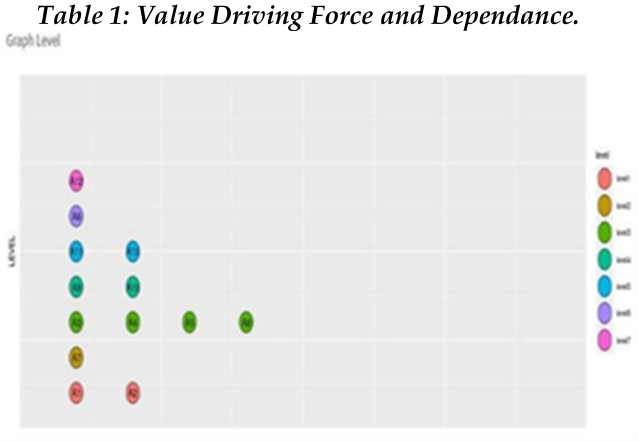
that is equal to or greater than 0.5 X. Each element contains a certain number of sub-elements, denoted by X. Analyzing elements in quadrant III requires careful consideration, as any action taken on one element will inevitably impact the other elements in quadrants II and IV.

d. Quadrant IV, also referred to as the Activator (Independent), consists of sub-elements that have a Driving Power (DP) value that is equal to or greater than 0.5 X, and a Dependence (D) value that is equal to or less than 0.5 X. Each element is represented by X, which denotes the number of sub-elements.

4. EMPIRICAL RESULTS AND DISCUSSION

The roles of the parties are categorised according to their interests in the management of the Ambang catchment. influence/authority Influence is the authority or power that emanates from an institution to influence the implementation of management actions in the Ambang catchment. The parties have varying degrees of influence and interests in the management of the Ambang catchment.

Table 1: Value Driving Force and Dependance.



The elements are categorized into four quadrants for classification.Table 1 presents the driving power and dependence level of each variable in causing completion delays. By analyzing this data, one can gain insights into the unique attributes of each factor. BBWS Brantas (A1) and Balai Brantas Sampean (A2) (red circle) are considered to be important stakeholders at Level 1, as indicated in the table. Identifying the root cause characteristic involves pinpointing the factor that has the greatest impact and the least reliance on other factors. The effectiveness of the flood control program relies on the actions taken by the stakeholders. Ignoring these stakeholder elements can lead to the failure of the program. Ensuring that all stakeholders receive adequate attention is of utmost importance. Operating at level 2, the watershed forum and the Brantas TKPSDA play a crucial role in facilitating collaboration among various organizations. Their main objective is to establish a unified approach for effectively managing the Ambang river basin in Malang Raya. This approach focuses on tackling flood problems in a comprehensive and long-lasting way, engaging key stakeholders.

Understanding the contextual relationship of each factor and considering the potential relationship between two factors (a and b) requires careful consideration of the direction of the relationship. Table 1 illustrates the four symbols that indicate the relationship direction between two factors, a and b. After analyzing the data from questionnaire A, we generated the SSIM matrix and displayed it in Table 3.

Table 2: Matrix SSIM.

SSIM:

##	[,1]	[,2]	[,3]	[,4]	[,5]	[,6]	[,7]	[,8]	[,9]	[,10]	[,11]	[,12]	[,13]
## [1,]	NA	"O"	"O"	"O"	"O"	"O"	"O"	"O"	"O"	"O"	"O"	"O"	"O"
## [2,]	NA	NA	"O"	"O"	"O"	"O"	"O"	"O"	"O"	"O"	"O"	"O"	"O"
## [3,]	NA	NA	NA	"O"	"O"	"O"	"O"	"O"	"O"	"O"	"O"	"O"	"O"
## [4,]	NA	NA	NA	NA	"O"	"O"	"O"	"O"	"O"	"O"	"O"	"O"	"O"
## [5,]	NA	NA	NA	NA	NA	"O"	"O"	"O"	"O"	"O"	"O"	"O"	"O"
## [6,]	NA	NA	NA	NA	NA	NA	"O"	"O"	"O"	"O"	"O"	"O"	"O"
## [7,]	NA	NA	NA	NA	NA	NA	NA	"O"	"O"	"O"	"O"	"O"	"O"
## [8,]	NA	NA	NA	NA	NA	NA	NA	NA	"O"	"O"	"O"	"O"	"O"
## [9,]	NA	NA	NA	NA	NA	NA	NA	NA	NA	"O"	"O"	"O"	"O"
## [10,]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	"O"	"O"	"O"
## [11,]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	"O"	"O"
## [12,]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	"O"
## [13,]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Now, let's move on to the next step of the ISM approach, which involves generating an initial reachability matrix using SSIM. This can be achieved by substituting the four SSIM symbols (V, A, X, or O) with binary digits 1 or 0 in the initial reachability matrix. Here are the guidelines for replacements: When V is the value of entry (a, b) in SSIM, the reachability matrix will reflect this by assigning a value of 1 to entry (a, b), and a value of 0 to entry (b, a). If the value of entry (a, b) in SSIM is A, then the corresponding entry in the matrix will be 0, while the entry (b, a) will be 1. If the entry (a, b) in SSIM is X, then the corresponding entry in the matrix will be 1. Similarly, the entries (b, a) will also be assigned a value of 1. If the value of entry (a, b) in SSIM is O, then the corresponding entries in the matrix will be set to 0. Similarly, the entry (b, a) will also be assigned a value of 0. Table 4 displays the initial accessibility matrix.

Table 3: Initial Reachability Matrix (RM).

INITIAL REACHABILITY MATRIX

##	[,1]	[,2]	[,3]	[,4]	[,5]	[,6]	[,7]	[,8]	[,9]	[,10]	[,11]	[,12]	[,13]
## [1,]	1	0	0	0	0	0	0	0	0	0	0	0	0
## [2,]	0	1	0	0	0	0	0	0	0	0	0	0	0
## [3,]	0	0	1	0	0	0	0	0	0	0	0	0	0
## [4,]	0	0	0	1	0	0	0	0	0	0	0	0	0
## [5,]	0	0	0	0	1	0	0	0	0	0	0	0	0
## [6,]	0	0	0	0	0	1	0	0	0	0	0	0	0
## [7,]	0	0	0	0	0	0	1	0	0	0	0	0	0
## [8,]	0	0	0	0	0	0	0	1	0	0	0	0	0
## [9,]	0	0	0	0	0	0	0	0	1	0	0	0	0
## [10,]	0	0	0	0	0	0	0	0	0	1	0	0	0
## [11,]	0	0	0	0	0	0	0	0	0	0	1	0	0
## [12,]	0	0	0	0	0	0	0	0	0	0	0	1	0
## [13,]	0	0	0	0	0	0	0	0	0	0	0	0	1

The affordances encompass both the component itself and any other factors that may exert an influence on it. The collection of antecedents comprises the factor itself and those factors that have the potential to have impact on it. The intersection of this set determines the components and their respective levels. Factors that have identical range and intersecting points are positioned at the highest level of the ISM hierarchy. elements at the highest level do not have priority over other elements in the hierarchy. During the process of identification, these elements are excluded from consideration, and the same process is repeated to find factors at the subsequent level. This technique is iterated until the level of each factor is ascertained. The inclusion of these levels is crucial in the construction of an ISM diagram.

The ISM diagram is organized according to a visual depiction of the connection between variables, as illustrated in Table 1. The figure identifies BBWS Brantas (A1), Balai Brantas Sampean (A2), and the Brantas DAS and TKPSDA Forum (A4) as the main stakeholders.The correlation between the variables at level 1 indicates that the policy of BBWS Brantas (A1) can also have an impact on the Sampean Brantas Hall (A2). This scenario exemplifies the impact of policy on execution. A1 and A2 are closely linked to the policy dimensions of the project, necessitating a thorough examination of the government's policy administration concerning river basins and flooding.The final affordability matrix is derived from Table 4 by applying the principle of transitivity. The reachability matrix quantifies the 'driving power' (influencer power) and 'dependence power' of each supporter. In the final affordance matrix table, the driving power for A1 (BBWS Brantas) is decided by the total count of values entered in this row, which is 13. The 'Dependence Power' for A1, which represents the number of entries in the column, is 4. The values for 'Driving Force' and 'Dependence Power' have been computed for all the remaining supporters and are presented in Table 3.

5. CONCLUSSION

When it comes to reducing flood risks, not all flood management actors are equally important. When it comes to mitigating flood risk, every stakeholder has their own unique priorities. Restoration, humanitarian concerns, security, money, reputation, primary responsibilities, incentives, and relocation are all part of this. Among the many goals that have an effect on flood risk reduction, two stand out: restoration and humanitarian considerations. When it comes to lowering flood risks, these primary goals are crucial. As part of the restoration process, stakeholders are motivated to cultivate, preserve, and enhance infrastructure and natural resources like floodgates, levees, and rivers. When addressing this matter, remain impartial and refrain from using prejudiced terminology. It is possible to classify those involved in the fight against floods as either beneficiaries, middlemen, or legislators. National strategies for disaster risk reduction are made by BBWS Brantas and Balai Brantas Sampean. In order to lessen the likelihood of floods in the Malang region, they are crucial. In order to foresee potential flooding issues in Greater Malang, it is critical to observe coordinated efforts among all relevant parties. These limitations suggest that future research should adopt stakeholder roles in a broader geographical scope so as to involve broader stakeholders to prevent flooding with integrated watershed management.

Acknowledgements: The authors are grateful to the National Research Agency (BRIN Indonesia) and Padjadjaran University Bandung. This research is a component of a dissertation proposed as part of Padjadjaran University's doctoral degree requirements.

REFERENCES

Attri, R.; Dev, N.; Sharma, V. Interpretive structural modelling (ISM) approach: An overview. Res. J. Manag. Sci. 2013, 2319, 1171

Bryson, J.M., 2003, What to do when stakeholders matter: A guide to stakeholder identification and analysis techniques, George-town University Public Policy Institute,Washington, DC

Crosby, B., 1991, 'Stakeholder analysis: A vital tool for strategic managers, A Publication of USAID's Implementing Policy Change Project, No 2, March 1991. 1–6

Fowler, H.J. & Wilby, R.L., (2010), 'Detecting changes in seasonal precipitation extremes using regional climate model projections: Implications for managing fluvial flood risk', Water Resources Research 46, 1–17 https://doi.org/10.1029/ 2008WR007636

Gaur, V., (2013), 'Understand your stakeholders', International Journal of Advancements in Research & Technology 2(1), 1–8. ISSN 2278-7763

Gonsalves, J., Becker, T., Braun, A., Campilan, D., De Chaves, H., Fajber, E. et al., 2005, Participatory research and development for sustainable agriculture and natural resource management: A sourcebook, vol. 1, International Potato Center-Users' Perspectives with Agricultural Research and Development, Laguna, Philippines and International DevelopmentResearch Centre, Ottawa, Canada

Hora SC. 2004. Probability judgments for continuous quantities: linear combinations and calibration. Management Science 50 (1) : 597-604

Indonesian Disaster Risk Book (2023). Flood Disaster. BPBN, Jakarta

Iqbal, M., 2007, 'Analisis peran pemangku kepentingan dan implementasinya dalampembangunan pertanian', Jurnal Litbang Pertanian 26(3), 88–99

Isa, M., Sugiyanto, F.X. & Susilowati, I.. (2015), 'Adaptation and mitigation model for people to restore their ecosystem from flood in Semarang, Indonesia', Jurnal Ekonomi Pembangunan 16(2), 166–173

Isa, M., (2016), Natural Disaster: Negative or Positive Impact to Economy Growth?, The 3rd University Research Colloquium 2016, Kudus, 147-156.

Janes, F. R. (1988). Interpretive Structural Modelling: a Methodology for Structuring Complex Issues. Transactions of the Institute of Measurement and Control, doi:10.1177/014233128801000306

Kartodiharjo H, K Murtilaksono, U Sudadi, (2004). Institusi Pengelolaan Daerah Aliran Sungai; Konsep dan Pengantar Analisis Kebijakan. Bogor, Jawa Barat: Fakultas Kehutanan Institut Pertanian Bogor

Khan, J.; Haleem, A.; Husain, Z. Barriers to technology transfer: A total interpretative structural model approach. Int. J. Manuf.Technol. Manag. 2017, 31, 511–536

Li, M.; Yang, J. Analysis of interrelationships between critical waste factors in office building retrofit projects using interpretive structural modelling. Int. J. Constr. Manag. 2014, 14, 15–27

Lienert, J. & Schnetzer, F., 2013, 'Stakeholder analysis combined with social network analysis provides fine-grained insight into water infrastructure planning processes', Journal of Environmental Management 125, 134–148. https://doi.org/10.1016/j.jenvman.2013.03.052

Nasrullah dan Kartiwa, B. (2010). Analisis Alih Fungsi Lahan dan Keterkaitannya dengan Karakteristik Hidrologi DAS Krueng Aceh. Jurnal Tanah Dan Iklim No. 31/2010. Peneliti pada Balai Penelitian Agroklimat dan Hidrologi, Bogor

Nasution S. 2011. Metode Penelitian Naturalistik-Kualitatif. Bandung (ID). Cv.Tarsito

Nugroho S.P. (2003). Pergeseran Kebijakan dan Paradigma Baru Dalam PengelolaanDaerah Aliran sungai di Indonesia. Jurnal Teknik Lingkungan P3TLBPPT.4(3), 136-142

Permatasari (2017). Pengaruh Perubahan Penggunaan Lahan terhadap Rezim HidrologiDAS, Jurnal Teknik Sipil ITB, Bandung

Pitt, M., (2008), The Pitt review: Learning lessons from the 2007 floods, Cabinet Office, London.

Race, D. & Millar, J., 2008, Social and community dimensions to ACIAR projects, ACIA Training Manual, Charles Sturt University, Australian Centre for International Agricultural Research, Canberra

Raman, M. Ojo, A.O. & Dorasamy, M., (2015), 'A stakeholder perspective in managing floods in Malaysia', Sustainable Development 2, 117

Reed, M.S., Graves, A., Dandy, N., Posthumus, H., Hubacek, K., Morris, J. et al., 2009, 'Who's in and why? A typology of stakeholder analysis methods for natural resource management', Journal of Environmental Management.https://doi.org/10.1016/j.jenvman.2009.01.001

Shouwu, J.; Yong, X.; Zheng, L. Analysis on the Factors Influencing the International Technology Transfer Based on ISM Model. Int. J. Econ. Financ. 2016, 8, 206