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Gap Analysis in Deli Watershed Management Measured by Stakeholders' Social Factors Deli North Sumatera

Jen Christ David[1,*], Abdul Rauf[2], Hamdani Harahap[3]

[1]*Agriculture and Fisheries Affairs Office of Medan City, Sumatera Utara, Indonesia*
[2]*Department of Agroecotechnology, Faculty of Agriculture, Universitas Sumatera Utara, Indonesia*
[3]*Department of Social Anthropology, Faculty of Social and Political Sciences, Universitas Sumatera Utara, Indonesia*

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Corresponding Author
E-mail:
jenchristdavid@gmail.com

ABSTRACT

A watershed is an area encompassing rivers and tributaries, which functions as a container, a reservoir, a water drainage system, and a home for human activities and other living things, either living on the banks of the river or living in a watershed. This research is a qualitative descriptive study that used interviews and questionnaires to collect the data. This study examined four main factors in Deli Watershed Management: stakeholders' capacity level, knowledge levels, attitudes, and the gap in watershed management. The t-test result showed the correlation's capacity level as an insignificant variable ($p > 0.05$). The regression model that describes the correlation between stakeholders' knowledge level, stakeholders' attitudes, simultaneously, and the gap in the management of the Deli Watershed Management amounting to $y = 1.164 - 0.173\ x1 - 0.470x2$ where x1 = level of knowledge and x2 = attitudes. The value of $r = 0.704$ indicates that the correlations between these variables are strong. Meanwhile, the adjusted R square value is 0.460. The F-test suggests that 46% of the variation in the gap in the Deli Watershed Management was due to stakeholders' knowledge levels and attitudes in implementing the management. Thus, social inequality in watershed management correlates with stakeholders' knowledge and perspectives. Still, it does not have an accurate correlation with stakeholders' attitudes.

INTRODUCTION

A Watershed is an area integrated with rivers and tributaries functioning as reservoirs, containers, and draining water to lakes or seas naturally (PP Number 37 of 2012). According to Berutu et al. (2015). Watersheds are home to living things, including humans, and are necessary for various activities that support human life. The Watershed has three main components as a place utilized or used by humans. Those are biotic, physical, and social components that interact and influence others (Astuti & Berutu, 2012).

Aulia et al. (2018) stated there are at least five functions of a watershed, among those areas a container for draining water from upstream to downstream, a buffer area for peak rain events, for releasing water gradually, maintaining water quality, and reducing landmass discharges, such as landslides. Currently, watershed conditions in Indonesia are very worrying due to the lack of management carried out. Watershed Management is a human action that aims to ensure and maintain the use of watershed resources, with various approaches, one of which is an integrated ecosystem approach to support the

sustainability of existing resources in the Watershed by performing balanced conservation among all aspects contained in a watershed, including water, soil, and vegetation (Ahn & Kim, 2017).

Watershed Management is the Government's responsibility since the Watershed is a strategic area needed for social, economic, cultural, and environmental sustainability (Epstein et al., 2015). Watershed Management serves to maintain and preserve the condition of water resources in rivers and their tributaries and prevent natural disasters due to the damage of river flow. All the stakeholders must carry out the watershed management as it requires a large amount of funding, human resources, involvement of various parties and stakeholders in performing the management. (Jaiswal et al., 2015). Watershed Management is complex since it must consider and reconcile different interests across sectors and users (Sulistyaningsih, 2021).

Based on Government Regulation Number 37 of 2012, the management of watersheds is carried out through several processes: planning, implementation, monitoring, evaluating, training, and supervising. Watershed management is complex because it requires integrating information, technology, natural processes, institutions, decision-makers, water usage, and social options to produce the best management mechanism. According to Amalia (2013), the goal of river management is to reverse the level of declines in the river quality caused by the presence of various waste from human activities into the river.

Faisah & Prianto (2015) stated that one of the applicable watershed management systems is the application of an Environmental Governance System, which is an interaction between available social factors with the environment that is managed conceptually. This concept emphasizes understanding and managing the interrelation between social systems and ecosystems. According to Ernst (2019), environmental management (including watersheds) requires participatory management to improve decision-making in sustainable management.

Tresnadi (2008) explicitly states that the complexity, especially in water resources management, lies in understanding the complex correlation between its utilization and local hydrological and hydrogeological conditions to balance water supply and demand. Gibbs et al. (2012) state that water resource management must provide answers. If all the needs for the population, agriculture, industry, and so on are met, there will be an adequate supply remaining to sustain ecosystems. The second challenge for those who manage water resources is to find a way to use available resources to increase economic, environmental, and social benefits simultaneously. Adding to the complexity is finding a way to perform the dynamic management mechanism to account for continuously changing variables.

This study looked specifically at the Deli Watershed in Medan City's vicinity. According to the Decree of the Minister of Public Works Number 52 of 2012 concerning the Pattern of Water Resources Management of Belawan Ular Padang River Basin. Deli River is designated as part of the Belawan-Ular-Padang River area, called the Watershed, with 6,215.66 Ha. Deli Watershed is divided into the Karo Regency, Deli Serdang Regency, and Medan City. The upstream of the Deli watershed is in Karo Regency and Deli Serdang Regency (Sibolangit District), and the downstream is in Medan City (Belawan District).

Deli Watershed plays a vital role in providing water for daily necessities, agricultural activities, tourism, and various industrial activities. Yet, inadequate conservation efforts from the Government, stakeholders, and multiple parties in maintaining its sustainability have made the Deli Watershed the most polluted river in North Sumatra.

Watershed damage is a socio-environmental problem. King & McCarthy (2014) explain that the emergence of environmental issues is also moved by social phenomena such as social inequality,

culture, power, politics, government relations with the economy, and other social problems. Therefore, addressing the environmental issues needs to involve social approaches. Human life on earth cannot be separated from its interactions with nature and the environment. A man will inevitably become a part of his environment when he is born into the world. Therefore, over time, the environmental condition will affect human behavior, and otherwise, human behavior will impact the environment (Adnan, 2006).

This study analyzed the correlation between the stakeholders' social factors, namely, stakeholders' capacity level, knowledge levels, attitudes, and the gap in the Deli Watershed Management. This research is essential because the results will provide the data needed by all stakeholders to build effective and sustainable watershed management in line with the Government Regulation.

RESEARCH METHODS

This research was conducted in the Deli Watershed area, which administratively includes three regencies/cities: Karo Regency, Deli Serdang Regency, and Medan City. This research used questionnaires, interviews, and a literature study in collecting the data. The respondents are officials responsible for planning and implementing programs/activities related to Watershed Management at the institutional level.

Qualitative variables were measured directly using the indicators scored on a Likert scale, with the following process:

1. Create measurement instruments and develop indicators
2. Develop questionnaires
3. Calculate the total score based on the respondent's answer
4. Grouping the percentage scores into five categories, namely:
   - Category I: ≥ 80.1% (very good/very wide)
   - Category II: 70.1-80% (good/wide)
   - Category III: 60.1-70% (enough)
   - Category IV: 50.1-60% (less/narrow)
   - Category V: ≤ 50% (very poor/very narrow)

The variables measured in this study include:

1. The Capacity of Management Agencies/Organizations.

   It refers to an organization's ability to recognize and utilize its existing resources to improve its management of the Deli Watershed.
2. The Manager's Level of Knowledge.

   It referred to the manager's understanding of integrated watershed management principles. This knowledge is generally summarized in The Regulation of Forestry Minister Number P.24 / MENHUT-II / 2009, concerning General Patterns, Criteria, and Standards for an Integrated Watershed Management.
3. The Manager's Level of Attitudes.

   The manager's level of attitudes is quantified by the Fishbein model, which states that the overall attitude towards an object is an accumulation of beliefs and evaluations as illustrated in the following equation:

$$A_0 = \sum_{i=1}^{N} b_i e_i$$

   where:
   A_0: the overall attitude towards the object
   b_i: the power of belief that an object has I attribute
   e_i: assessment on the ethical value of attribute I (good or bad)
   N: the number of trusts

4. Gaps in the Management of Deli Watershed

   It referred to a discrepancy between the expected management and actual conditions. The value of the gap is quantified by adapting the gap variable in watershed management conditions that commonly happens throughout Indonesia as written in the Regulation of Forestry Minister Number P.24 /

MENHUT-II / 2009 concerning General Patterns, Criteria, and Standards for Watershed Management.

RESULTS AND DISCUSSION

Capacity Measurement

A stakeholder's capacity is one of the main elements in implementing the management. Without competent ability, the command will not run well and will not produce the expected results. Each stakeholder's capacity has different percentages because each stakeholder differs in educational level and study background, ranging from bachelor's to master's degree. Table 1 below shows the rates in capacity and stakeholders' capacity in The Deli Watershed management.

Table 1. Elements of stakeholder's capacity in deli watershed management

No	Capacity Field	Stakeholder Capacity (%)
1.	Administration	25.00
2.	Organizational Management	25.00
3.	Human Resources	28.57
4.	Financial	32.14
5.	Program Management	32.14
6.	Organizational Governance	35.71

Source: Research results, 2020.

Table 1 shows that the highest percentage is the capacity in Organizational Governance of 35.715% and the lowest in the degree in the administration of 25%. The high rate in Organizational Governance is due to the ability of each organization/agency to identify the resources it must manage in the Watershed.

Besides carrying out its main tasks focused on the management of the Deli Watershed, each stakeholder also carries out other functions that are not related to the control. As a result, institutionally, each stakeholder made outstanding achievements in line with institutional capacity, even though it has not been achieved optimally at the individual level at specific domains.

The irrelevance of correlation between each stakeholder's capacity and management gaps is due to the different visions each institution and stakeholders have in implementing the management. For example, Deli Serdang Regency's territory encompasses eight Watersheds, consisting of Wampu, Belawan, Asam Kumbang, Deli, Percut, Note, Batang Kuis, and Ular. Among those eight, only five watersheds have priority I watershed status, with the handling priorities being on critical land, erosion, sedimentation, and population pressure. Those watersheds are Wampu, Deli, Ular, Belawan, and Percut. Each of these watersheds has its vital yet different contribution to Deli Serdang Regency. They also differ in the percentage of its area in the Deli Serdang administrative area. The conditions depicted above influenced the Government of Deli Serdang Regency in determining which Watershed will be a priority for handling. Therefore, it is necessary to distinguish between institutional and other achievements in specific areas, namely the Deli Watershed management.

Knowledge Level Measurement

The measurement results of the level of knowledge, ranging from sufficient to very insufficient, showed that 51.51% of stakeholders still have inadequate knowledge regarding watershed management principles. This wrong stakeholders' knowledge contributed significantly to the widening gap in managing the Watershed. This phenomenon was thought to have occurred due to the emergence of different perspectives on essential matters concerning watersheds management. From the interview, we found

one exemplary case that there was a tendency for stakeholders to understand a watershed solely as a river and its banks. Whereas in the actual definition, the watershed area covers the entire stretch of land. The fallen rainwater is collected in a river system, from upstream to downstream. Thus, the watershed management approach must be unified/integrally, which means administrative boundaries cannot separate. Figure 1 below shows each administrative area's different perspectives regarding Deli Watershed management.

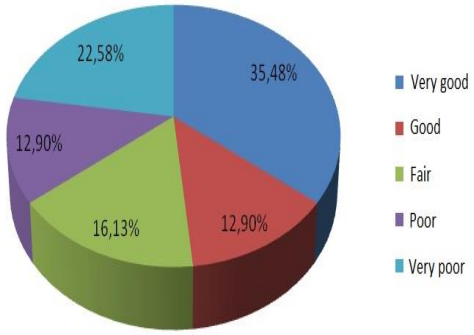

Figure 1: The percentages of stakeholders' knowledge level

Figure 1 shows the difference of percentages of the stakeholders' level of knowledge in implementing The Deli Watershed Management, with the highest rate being perfect, at 35.48%, and the lowest percentage being good and less, both at 12.90%. This difference has become a persistent problem at the agency level that carries out the management of the Deli watershed, namely differences in perceptions on how to undertake watershed management. Each management agency must resolve this problem to achieve management results following applicable regulations. Table 2 below gives further explanation on how stakeholders' perspectives differ.

Table 2. Differences in stakeholders' perspective of deli watershed management based on administrative areas

No	Administration Area	Stakeholders' Perspectives
1	Medan City	Medan City did not have complete control over the management of Deli Watershed and was only the recipient of the impact of the damage that had occurred upstream. This situation was reflected in the poor quality of the Deli River.
2	Deli Serdang Regency	Deli Serdang Regency area encompassed several watersheds thus, Deli Watershed management was not the priority of their administration of watersheds management since it did not contribute to their agricultural land. Moreover, the Deli River is one of the rivers that traverse cities/ regencies; therefore, the authority lies with the Provincial Government.

3	Karo Regency	Deli Watershed did not play a vital role for the community in the Karo Regency administrative area for the following reasons: Only a tiny part of the Deli Watershed area was included in the administrative area of Karo Regency, where most of that area has been designated in the spatial plan as a conservation forest, and only clusters with relatively narrow spaces were provided for development (cultivation) areas, precisely in Doula village and Semangat Gunung village. Therefore, the management of Deli Watershed was not a priority.

The Level of Stakeholders' Attitudes

Stakeholders' attitudes are attitudes and understandings of stakeholders in observing and implementing the Deli Watershed Management Program. Figure 2 below shows the percentages of stakeholders' attitudes in the management:

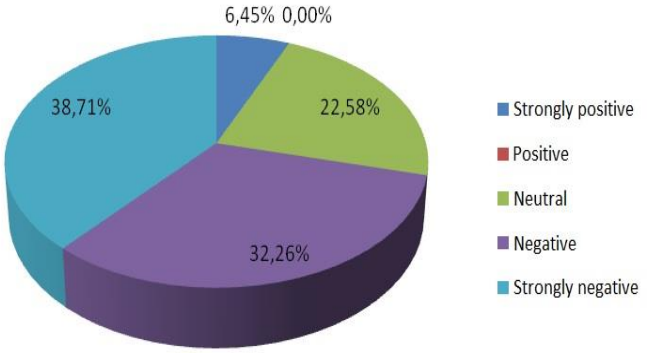

Figure 2: Percentages of stakeholders' attitudes

Figure 2 shows that the highest percentage of stakeholders' attitudes towards Deli Watershed management were very negative attitudes, amounting to 38.71%, and the lowest attitudes were neutral attitudes, at 0.00%.

The high levels of very hostile and negative attitudes are due to stakeholders' presumptions that the Integrated Deli Watershed Management is merely a concept that is almost impossible to implement unless there is a strong, governing and authoritative Government in implementing watershed management. Statistical analysis shows that there is a significant correlation between attitudes and gaps. Thus, stakeholders' dominantly negative attitudes can have contributed to widening the hole in Deli Watershed Management. This phenomenon happened because attitudes are the elements that form behaviors. A negative attitude will lead someone to behave as if something is not essential, useless, difficult, boring, and so on, resulting in a performance that tends to be not up to standard (Periantalo, 2014). The interview results confirmed this statistical analysis. Some stakeholders argued that integrated watershed management is more than a concept that will be difficult or even nearly impossible to implement. Respondents' experiences involved in the Watershed Forum say that the recommendations produced by the Watershed Forum, even as a product of a coordination forum among various stakeholders, will ultimately conflict with the interests of each stakeholder or sectoral ego. In the end, these recommendations will only be limited to suggestions or inputs that will never be implemented.

The Measurement of the Gap in Deli Watershed Management

Management gap measurement is a measurement of the success rate of a management implementation. The research results using variables of management aspects showed that the average respondents stated that there was a gap in the management due to the different visions of each stakeholder. The measurement of the management gap showed that the hole in the management information system and the application of incentives ranked the highest levels, amounting to 92.86%, and the institutional gap, to be in the lowest level, at 60.71%. Table 3 shows the detail:

Table 3. Levels of a gap in the deli watershed management

No	Management Aspects	Respondents' Statements (%)
1	Watershed Management Information System	92.86
2	Application of incentives and disincentives	92.86
3	Financing	89.29
4	Control	82.14
5	Implementation	82.14
6	Stakeholders' Participation	82.14
7	Planning	67.86
8	Institutional	60.71

Source: Research results, 2020.

In line with the research results, interview results described that the condition of the running management of the Deli watershed tended to run partially. Therefore, stakeholders found difficulties aligning their visions and actions with one another. Some respondents even thought that the stakeholders' harmony of concepts and activities was almost impossible to achieve.

The Correlation between Stakeholders' Capacity, Attitudes, and Knowledge Level with the Gaps in Deli Watershed Management

This study did not find a significant correlation between stakeholders' capacity, knowledge levels, and attitudes simultaneously with the gap in the management condition of the Deli watershed. Only knowledge level and attitudes are the factors that affect the gap. The research found that although the stakeholder's capacity was high, their knowledge level was low, and attitudes were negative, the gap in the Deli Watershed management was still vast. This showed that the capacity has not yet closed the management gaps. The research found three reasons why the power of stakeholders did not contribute effectively to the management of Deli Watershed:

a) Almost all of Deli Watershed Stakeholders have not yet put the watershed management in their priority. They played their role as it is only part of the various main tasks and functions. The study on gap measurement in the aspect of "stakeholder participation" found that most stakeholders said "No" for the question of Deli Watershed management has become their priority.
b) The vision developed by stakeholders did not specifically focus on Deli Watershed management. The emergence of different perspectives among the three administrative areas (Table 2) confirmed the assumption that the capacity has not yet been directed optimally to Deli Watershed management.
c) The lack of knowledge in the watersheds management confirmed the assumptions of why the activities they carried out were not on target. In terms

of abilities, there were possibilities that stakeholders might be able to accommodate and bear the high task load in line with their capacity. Yet, the programs/activities they implemented have not yet hit the target.

The t-test results showed that the capacity was insignificant (p> 0.05). This showed that the wide or narrow gaps that occurred in the management of the Deli watershed were not significantly correlated to the current stakeholders' capacity.

The Regression model that depicted the correlation between the stakeholders' knowledge level and attitudes with the gap in the management of the Deli watershed was y = 1.164 - 0.173 x1 - 0.470x2; where x1 = level of knowledge and x2 = attitude. The value of r = 0.704 indicated that the correlations between these variables were strong.

The adjusted R square value was 0.460, and the F-test showed significant results. This indicated that stakeholders' knowledge level and attitudes could explain 46% of the variation in the gap of Deli Watershed management through the Regression model. The Regression model also provided information that in comparison to the increasing stakeholders' level of knowledge, the improvements in stakeholders' attitudes would be more responsive in closing the gap in Deli Watershed Management. Knowledge and attitudes can simultaneously be influential because there is a linkage between those variables. Knowledge can form a person's belief in something.

Furthermore, a person's beliefs will build that person's attitudes. Thus, perspectives emerge as a combination of a person's belief in something and self-evaluation. The questionnaire results showed that most stakeholders accept integrated watershed management principles as desired watershed management. However, looking at the current condition of Deli Watershed Management, it is found that the self-evaluation results corrected the belief component. Then, in the end, attitudes that emerged as a conclusion tended to be negative. The interview results showed that stakeholders even became skeptical of integrated watershed management and grew to think of it only as a concept that could not be implemented.

The intervention patterns to narrow the gap in the watershed management based on the variables in this study should be started with a program to increase stakeholders' knowledge about watershed management. Increasing knowledge is expected for stakeholders to have the same perspectives on Deli Watershed. This program should be accompanied by the effort to improve the belief component as one of the forming elements for attitudes. Knowledge about watershed management is technical; therefore, to be accepted by various groups from different backgrounds and fields of study, this knowledge should be generalized to be more straightforward. Recently, the form that might represent it is the Principles of an Integrated Watershed Management as stipulated in the Regulation of Forestry Minister in 2009. Internationally, the same concept had also been disseminated and adopted for the various watershed management. The concept was known as Integrated Water Resources Management (IWRM). The essence conveyed in this concept is that the paradigm of rivers management is regarding the principles of rivers management. Moreover, the watershed management must be done thoroughly, beginning from the upstream water catchment until the water drains into the sea; therefore, the river management must not be considered merely an administrative issue, let alone an administrative area issue of boundaries. Watershed management must be a management that is equitable for all its stakeholders and all people using the rivers.

CONCLUSION

The stakeholders' knowledge level and attitudes correlate significantly with the gap that occurred in the Deli watershed management area, but it is not the case with stakeholders' capacity. Stakeholders'

knowledge level and attitudes simultaneously contributed to most factors determining the narrow or wide gap in the Deli Watershed Management. However, we also need to consider other cofactors.

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