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# Analysis of Factors Leveraging Sustainability of Community-Based Drinking Water Supply (Case Study of Drinking Water Supply for The Pamsimas Program, Kapongan Sub-District, Situbondo Regency)

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**Abstract**

The availability of sufficient drinking water is a fundamental human right and a key objective of Sustainable Development Goal (SDG) number 6. The PAMSIMAS program, a government initiative, aims to enhance access to drinking water in rural areas through a community-based approach. This research focuses on identifying key factors influencing the sustainability of drinking water provision in the ongoing PAMSIMAS Program in Kapongan Sub-district, Situbondo Regency. The study employs a quantitative approach using the Rap-SPAM method analysis, a modification of Rapfish. Primary data, obtained from surveys, observations, and interviews through questionnaire responses, is complemented by secondary data from literature reviews and relevant agencies. The Rap-SPAM simulation identifies 18 crucial attributes or leverage factors for sustaining community-based drinking water provision in PAMSIMAS, emphasizing environmental, social, economic, technological, and institutional dimensions. Key attributes in the environmental dimension include surrounding land conditions, pollution potential, rainfall patterns, and raw water quantity. Social dimensions highlight community meetings, water usage practices, and community trust. Economic factors encompass contributions for network development, fund availability, user contributions, and affordability. Technological aspects include water usage efficiency, ease of technology application, network leakage, and water quality. Institutional dimensions cover organizational structure clarity, manager reporting, and adherence to drinking water management regulations.

**Keywords:** drinking water supply system, PAMSIMAS program, rapfish, sustainability

## Introduction

Water is an essential need for humans in their daily activities and to meet all kinds of necessities (Febrina & Ayuna, 2014). The availability of water must meet certain quality and sufficient quantity standards, as it is a fundamental human basic need. The government aims to achieve the Sustainable Development Goals (SDGs), particularly goal number 6, which aims to ensure universal, safe, and affordable access to drinking water by 2030. This goal holds significant importance because adequate access to drinking water is a fundamental human right and plays a crucial role in improving health and the well-being of communities (Bappenas, 2020).

One of the government programs to fulfill access to drinking water for the community is through the Community-Based Drinking Water Supply and Sanitation Program (PAMSIMAS) (https://pamsimas.pu.go.id). The PAMSIMAS program has become one of the flagship programs initiated by both the central and local governments to improve the availability of adequate drinking water and sanitation facilities for rural population through community-based approaches. Government programs emphasizing empowerment have provided valuable experiences in cost reduction for a project while maintaining quality standards equivalent to non-empowerment programs (Soesanta, 2013). According to the CPMU PAMSIMAS Secretariat (2013), the PAMSIMAS program aims to increase the number of underserved population, especially those with low incomes, in rural and peri-urban areas to access sustainable drinking water and sanitation services.

The implementation of the PAMSIMAS Program is of significant importance as a vital raw water provider to address the current and potential clean water scarcity issues (Suheri et al., 2020). Kapongan Sub-district in Situbondo Regency is one of the areas that has implemented community-based drinking water provision through the PAMSIMAS Program. Five villages in this area received the PAMSIMAS program in 2017, 2018, 2021, and 2023. Currently, there are two villages in Kapongan Sub-district, namely Landangan Village and Pokaan Village, that still have functioning managed community-based drinking water systems. However, other villages no longer have a functioning drinking water supply system.

Ensuring the sustainability of drinking water provision for the population in the villages is a crucial aspect to guarantee access to drinking water in those areas (Swastomo & Iskandar, 2021). Various factors, both directly and interrelated, influence the sustainability of drinking water provision. Community participation, institutional structure, financing, and technical aspects are key factors influencing the sustainability of community-involved drinking water provision (Krisdhianto & Sembiring, 2016). Moreover, the sustainability of drinking water provision is also influenced by social, environmental, and economic factors (Djono, 2011). Previous research has identified various variables or factors that play a role in influencing the sustainability of water supply. However, these factors have not been systematically ranked based on their values in each aspect, necessitating the prioritization of factors as a step to enhance sustainability. This study aims to identify the leverage factors for the sustainability of drinking water provision in the PAMSIMAS program and prioritize sustainability factors to enhance and develop community-involved drinking water supply systems.

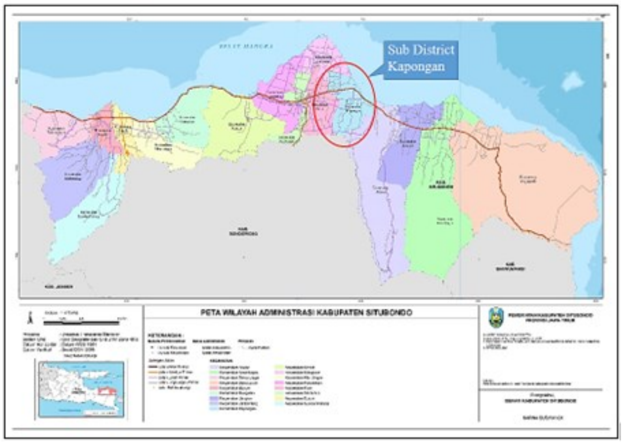



**Figure 1.** Administrative Map of Situbondo Regency

## Materials and Method

### Research Type

The design of this research is a quantitative research approach aimed at gaining clarity on the factors that act as leverage for the sustainability of community-based drinking water provision in the PAMSIMAS program in the Kapongan Sub-district.

### Research Location

This research was conducted in Pokaan Village within the community-managed drinking water supply system of Tirta Jaya, and in Landangan Village within the community-managed drinking water supply system of Samudra Mandiri, both located in the Kapongan Sub-district, Situbondo Regency, East Java Province. The selection of research locations is based on the fact that both villages still have functional PAMSIMAS programs with potential for development and enhancement of community -based drinking water supply management. The location map of Kapongan Sub-district is shown in Figure 1.

### Data Collection

This study utilized primary data collection methods through surveys, observations, and interviews with relevant respondents. Primary data were obtained from users and operators of the community-based water supply system. In terms of selecting user respondents for the water supply system in both villages, the approach used was simple random sampling, meaning respondents were selected without considering potential strata in water usage. On the other hand, for members of the community-based water supply system management groups, three members were chosen from the total members of the management group, consisting of the chairman, treasurer, and technician. The sample size for water users in each village was calculated using the Slovin formula with the following formula (Priyono, 2016):

$$n = \frac{N}{1 + N(e)^2}$$

Where:

$n$ : Sample size/number of respondents
N : Population size
$e$ : Percentage of desired sampling error; $e$=0.1

Based on this formula, the sample size for water users in Pokaan Village, Tirta Jaya's water supply group, is 50 respondents, while for Landangan Village, Samudra Mandiri's water supply group, it is 75 user respondents. In addition to primary data, this research also relies on secondary data to support the analysis and conclusions. These secondary data were obtained through a literature review from various relevant sources such as government agencies, universities, textbooks, reports, papers, and other sources relevant to this research.

**Research Procedure**

In this study, the sustainability index of community-based drinking water provision for the Pamsimas program in Kapongan Sub-district was determined using the Rap-SPAM method. This method is a modification of the Rapfish method, which was initially a statistical technique for quickly assessing the relative status of an entity, such as the fisheries sector, by assessing a set of pre-defined attributes grouped into evaluation fields or specific disciplines (Kavanagh and Pitcher, 2004). Although Rapfish was originally developed to analyze sustainability in the fisheries sector, the fundamental sustainability principles it employs can be applied to other sectors as well (Fauzi, 2022). The modification of this method involves adjusting the attributes and indicators used in the assessment process. The attributes and indicators in Rap-SPAM are formulated based on a literature review and adapted to the criteria of sustainability for community-based drinking water provision. Each attribute and indicator is selected to reflect the sustainability status of the Pamsimas program in each dimension. This method involves three main stages: attribute review and sustainability identification, scoring assessment, and data analysis using the integrated Rapfish application in Microsoft Excel.

**Table 1.** Determination of Dimension

| No | Dimension | Attributes |
|---|---|---|
| 1 | Environmental | Rainfall & rainy days, Surrounding land conditions, Pollution potential, Continuity of raw water, Protection of water sources and Quantity of raw water. |
| 2 | Social | Community trust, Community meetings, Desire for sustainability, Necessity of the water supply system, Concern for the water supply system and Practices of using the water supply system |
| 3 | Economic | Availability of funds for the development of the water supply system, Existence of fees for the development of the water supply system network, Fee adequacy with operations & maintenance, Regularity of fee payments, Affordability of user fees, and Existence of user fees |
| 4 | Technological | Network leakages, Quantity of obtained water, Efficiency of water use, Ease of technology application, Availability of water at all times, and Quality of received water |
| 5 | Institutional | Performance and financial reporting by the management to the users of the water supply system, Implementation of rules in water supply system management, User satisfaction, Activity of the management, Clear organizational structure, and Regulations for water supply management |

The determination of these attributes is based on five dimensions of sustainability: technical, social, financial, environmental, and institutional. The determination of these attributes is derived from the analysis of various relevant literature to assess the level of sustainability of community-based drinking water provision. The data obtained through questionnaires and interviews will be used as the basis for scoring assessment. The results of determining these attributes are expected to provide an overview of the influence on the sustainability level of the five observed dimensions, and the information can be seen in Table 1.

In the Multidimensional Scaling (MDS) analysis, leverage analysis and Monte Carlo

**Table 2.** Cumulative Values and Cumulative Percentage of Attributes for the

| No. | Attributes | RMS Value | Cumulative Value | Cumulative Percentage |
|---|---|---|---|---|
| 1 | Surrounding land conditions | 9.66 | 24.76% | 24.76% |
| 2 | Pollution potential | 8.29 | 21.25% | 46.00% |
| 3 | Rainfall & rainy days | 7.26 | 18.61% | 64.61% |
| 4 | Quantity of raw water | 5.82 | 14.92% | 79.52% |
| 5 | Continuity of raw water | 5.68 | 14.56% | 94.08% |
| 6 | Protection of water sources | 2.31 | 5.92% | 100.00% |
| **Total** | | **39.02** | **100%** | |

**Table 3.** Cumulative Values and Cumulative Percentage of Attributes for the Social

| No. | Attributes | RMS Value | Cumulative Value | Cumulative Percentage |
|---|---|---|---|---|
| 1 | Community meetings | 4.38 | 34.90% | 34.90% |
| 2 | Practices of using the water supply system | 3.26 | 25.98% | 60.88% |
| 3 | Community trust | 1.85 | 14.74% | 75.62% |
| 4 | Concern for the water supply system | 1.29 | 10.28% | 85.90% |
| 5 | Necessity of the water supply system | 0.93 | 7.41% | 93.31% |
| 6 | Desire for sustainability | 0.84 | 6.69% | 100.00% |
| **Total** | | **12.55** | **100%** | |

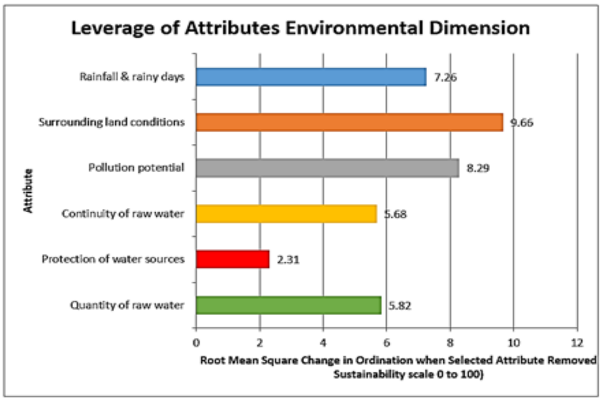



**Figure 2.** Graph of Sensitive Attributes for the Environmental Dimension

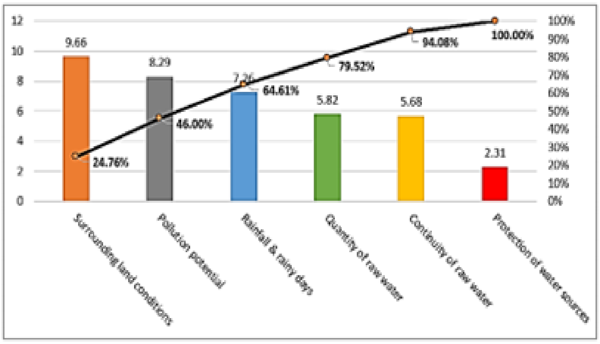



**Figure 3.** Graph of Leveraging Attributes for the Environmental Dimension

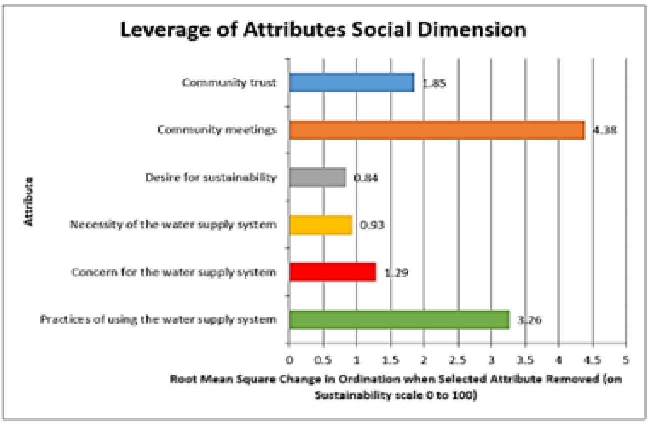
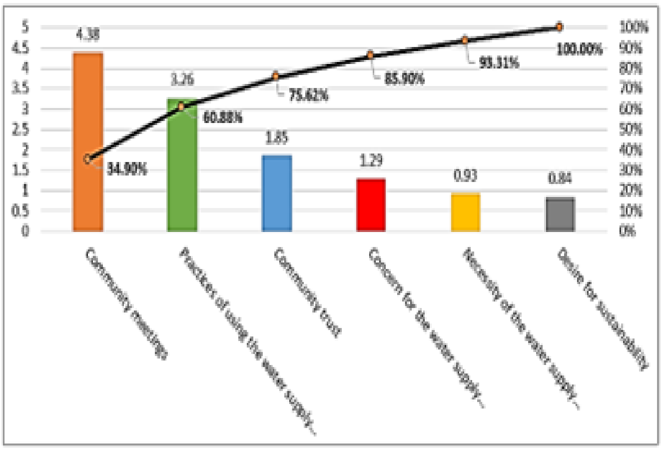



**Figure 4.** Graph of Sensitive Attributes for the Social Dimension



analysis were performed. Leverage analysis aims to identify sensitive attributes in each dimension. The level of sensitivity of these attributes in influencing the sustainability status in the respective dimensions is reflected in the Root Mean Square (RMS) values. The larger the change in the RMS value, the more sensitive the role of these attributes towards the sustainability status in the respective dimension. During the MDS analysis, stress, $R^2$ values, and Monte Carlo analysis results are also generated. Stress is used to assess how well the model fits the data. A good model can be identified by a stress value smaller than 0.25 or $S < 0.25$ (Kavanagh and Pitcher, 2004), and a good $R^2$ value approaches 1. Monte Carlo analysis is used to assess errors and uncertainty in the MDS results. If the difference between the MDS values and the Monte Carlo values is small, it can be interpreted that the Multidimensional Scaling (MDS) analysis to determine the sustainability level can be relied upon with a 95% confidence level.

The determination of leverage attributes is based on the Pareto Optimum principle, also known as the 80:20 rule (Bunkley, 2008 in Yusuf et al., 2021). The Pareto principle, in simple terms, states that in a system, there is a smallest percentage (20%) that has the largest value or impact (80%). In other words, 20% of the main factors can influence 80% of the impact (Yusuf et al., 2021). By identifying the attributes with significant influence, interventions can be made on these attributes to improve the sustainability index in community-based drinking water supply. According to Yusuf et al. (2021), the Pareto Optimum principle can be applied to determine the main attributes that affect sustainability in MDS analysis. The classification data is sorted from the highest RMS value to the lowest RMS value. The highest ranking indicates attributes with high priority or attributes with the highest sensitivity level in influencing the sustainability of the system. Conversely, the lowest ranking refers to attributes with the lowest sensitivity level. In other words, the ranking order of attributes based on the RMS value reflects the sensitivity level of these attributes to the system.

## Results and Discussion

A water supply system can be considered sustainable when several conditions are met: the system operates and is used effectively; it can provide appropriate levels of benefits, including quality, quantity, regularity, availability, efficiency, equity, reliability, and health aspects; it persists for a long period without negative impacts on the environment; all operational and maintenance funding needs are met; there is an institution responsible for system management; and there is adequate support from external parties (Schuringa, 1998 in Kamulyan, 2017).

**Leveraging Attributes in the Environmental Dimension**

Leverage analysis was conducted to identify sensitive attributes in the Environmental Dimension. The results of the leverage analysis on attributes in the Environmental Dimension for the sustainability of community-based drinking water supply in the PAMSIMAS program in Kapongan Sub-district are presented in Figure 2.

The results of the sustainability leverage attribute analysis in the environmental dimension, based on the Pareto Optimum principle (maximum 80%), are presented in Table 2. The cumulative percentage and RMS values for each attribute led to the identification of 4 out of 6 attributes that are the primary drivers of sustainability. These attributes are: (1) Surrounding land conditions (RMS-9.66 with a cumulative of 24.76%), (2) Pollution potential (RMS-8.29 with a cumulative of 46.00%), (3) Rainfall & rainy days (RMS-7.26 with a cumulative of 64.61%), and (4) Quantity of raw water (RMS-5.82 with a cumulative of 79.52%), as shown in Figure 3.

**Leveraging Attributes in the Social Dimension**

Leverage analysis was conducted to identify sensitive attributes in the Social Dimension. The results of the Leverage analysis on attributes in the Social dimension of sustainability of community-based drinking water provision programs (PAMSIMAS) in Kapongan Sub-district, as shown in Figure 4. Results of the sustainability leverage attribute analysis in the Social dimension, based on the Pareto Optimum principle (maximum 80%), as shown in Table 3, with cumulative percentage values and RMS values for each attribute, resulted in 3 out of 6 attributes that subsequently became the main leverage for sustainability: (1) Community meetings (RMS-4.38 with cumulative 34.90%), (2) Practices of using the water supply system (RMS-3.26 with cumulative 60.88%), (3) Community trust (RMS-1.85 with cumulative 75.62%), as shown in Figure 5.

**Table 4.** Cumulative Values and Cumulative Percentage of Attributes for the Economic

| No. | Attributes | RMS Value | Cumulative Value | Cumulative Percentage |
|---|---|---|---|---|
| 1 | Existence of fees for the development of the water supply system network | 3.08 | 24.06 % | 24.06% |
| 2 | Availability of funds for the development of the water supply system | 2.47 | 19.30 % | 43.36% |
| 3 | Existence of user fees | 2.10 | 16.41 % | 59.77% |
| 4 | Affordability of user fees | 2.06 | 16.09 % | 75.86% |
| 5 | Regularity of fee payments | 1.68 | 13.13 % | 88.98% |
| 6 | Fee adequacy with Operations & Maintenance | 1.41 | 11.02 % | 100.00 % |
| | **Total** | **12.8** | **100%** | |

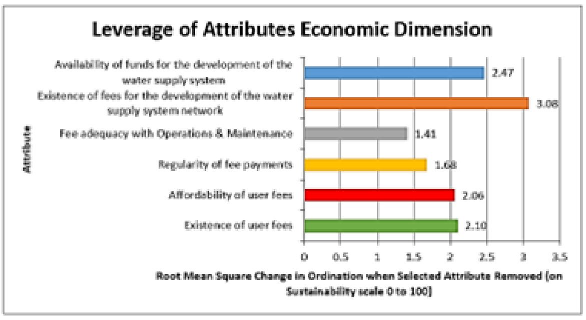



**Figure 6.** Graph of Sensitive Attributes for the

**Figure 6.** Graph of Sensitive Attributes for the Economic Dimension

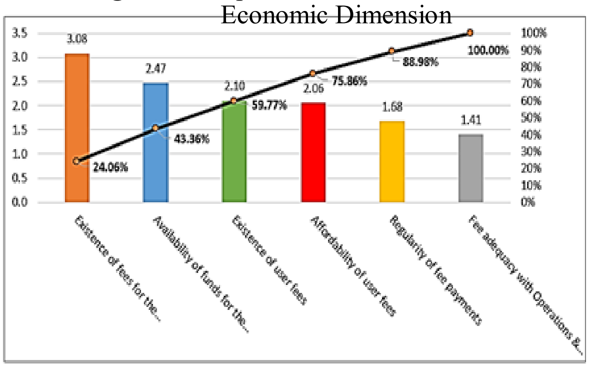



**Figure 7.** Graph of Leveraging Attributes for the Economic Dimension

**Table 5.** Cumulative Values and Cumulative Percentage of Attributes for the Technology Dimension

| No. | Attributes | RMS Value | Cumulative Value | Cumulative Percentage |
|---|---|---|---|---|
| 1 | Efficiency of water use | 11.23 | 26.24% | 26.24% |
| 2 | Ease of technology application | 7.80 | 18.22% | 44.46% |
| 3 | Network leakages | 7.38 | 17.24% | 61.71% |
| 4 | Quality of received water | 7.15 | 16.71% | 78.41% |
| 5 | Availability of water at all times | 6.77 | 15.82% | 94.23% |
| 6 | Quantity of obtained water | 2.47 | 5.77% | 100.00% |
| | **Total** | **42.8** | **100%** | |

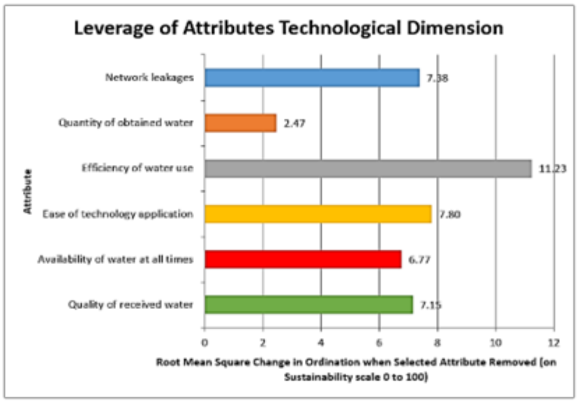



**Figure 8.** Graph of Sensitive Attributes for the Technology Dimension

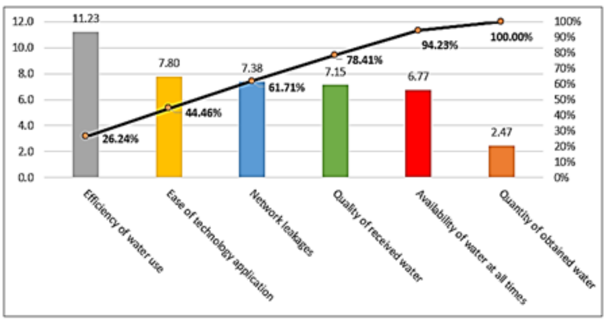



**Figure 9.** Graph of Leveraging Attributes for the Technology Dimension

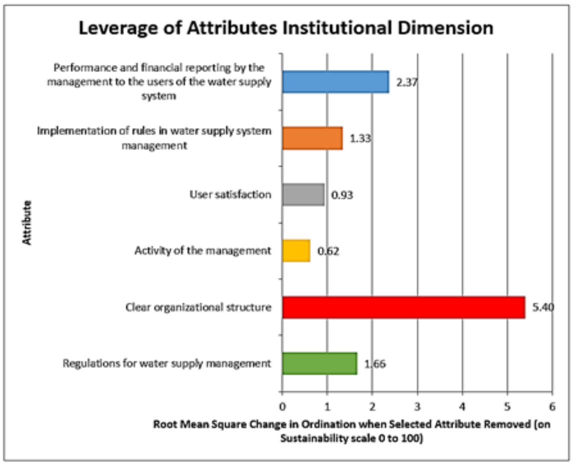



**Figure 10.** Graph of Sensitive Attributes for the Institutional Dimension

**Table 6.** Cumulative Values and Cumulative Percentage of Attributes for the Institutional Dimension

| No. | Attributes | RMS Value | Cumulative Value | Cumulative Percentage |
|---|---|---|---|---|
| 1 | Clear organizational structure | 5.40 | 43.87% | 43.87% |
| 2 | Performance and financial reporting by the management to the users of the water supply system | 2.37 | 19.25% | 63.12% |
| 3 | Regulations for water supply management | 1.66 | 13.48% | 76.60% |
| 4 | Implementation of rules in water supply system management | 1.33 | 10.80% | 87.41% |
| 5 | User satisfaction | 0.93 | 7.55% | 94.96% |
| 6 | Activity of the management | 0.62 | 5.04% | 100.00% |
| **Total** | | **12.31** | **100%** | |

**Table 7.** Stress and $R^2$ Values for All Dimensions

| **Dimensi** | **Parameter** | |
|---|---|---|
| | **Stress** | $R^2$ |
| Environmental | 0.15 | 0.94 |
| Social | 0.17 | 0.93 |
| Economic | 0.18 | 0.93 |
| Technology | 0.15 | 0.94 |
| Institutional | 0.17 | 0.94 |

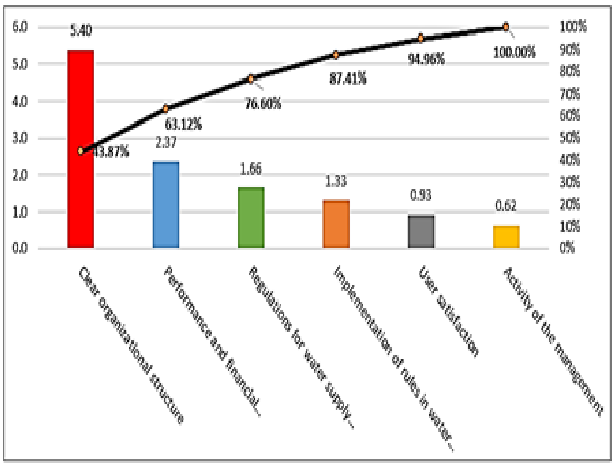



**Figure 11.** Graph of Leveraging Attributes for the Institutional Dimension

**Table 8.** Comparison of MDS Index with Monte Carlo

| **Dimensions** | **Location of Drinking Water Supply System** | |
|---|---|---|
| | **Landangan Village** | **Pokaan Village** |
| **Environment** | | |
| Index MDS | 67.11 | 54.33 |
| Monte Carlo | 65.53 | 54.17 |
| Deviation | 1.59 | 0.16 |
| **Social** | | |
| Index MDS | 55.58 | 55.98 |
| Monte Carlo | 55.33 | 56.04 |
| Deviation | 0.25 | 0.07 |
| **Economic** | | |
| Index MDS | 52.14 | 53.35 |
| Monte Carlo | 52.24 | 53.13 |
| Deviation | 0.10 | 0.22 |
| **Technology** | | |
| Index MDS | 61.26 | 67.45 |
| Monte Carlo | 60.08 | 66.31 |
| Deviation | 1.18 | 1.14 |
| **Institutional** | | |
| Index MDS | 59.71 | 61.82 |
| Monte Carlo | 60.28 | 61.85 |
| Deviation | 0.57 | 0.04 |

## Leveraging Attributes in the Economic Dimension

Leverage analysis was conducted to identify sensitive attributes in the Economic Dimension. The results of leverage analysis for attributes in the economic dimension of sustainability in the community-based water supply program PAMSIMAS in Kapongan Sub-district are shown in Figure 6.

Results of the analysis of sustainability leverage attributes in the Economic Dimension, based on the Pareto Optimum law (maximum 80%), as shown in Table 4, with cumulative percentage values and RMS values for each attribute, resulted in 4 out of 6 attributes that further became the main leverage for sustainability. These are: (1) Existence of fees for the development of the water supply system network (RMS-3.08 with a cumulative of 24.06%), (2) Availability of funds for the development of the water supply system (RMS-2.47 with a cumulative of 43.36%), (3) Existence of user fees (RMS-2.10 with a cumulative of 59.77%), (4) Affordability of user fees (RMS-2.06 with a cumulative of 75.86%), as shown in Figure 7.

**Leveraging Attributes in the Technological Dimension**

Leverage analysis was conducted to identify sensitive attributes in the Technological Dimension. The results of the leverage analysis on the attributes in the technological dimension for the sustainability of community-based drinking water supply program PAMSIMAS in Kapongan Sub-district are shown in Figure 8.

Results of the sustainability leveraging analysis in the Technological dimension are based on the Pareto Optimum law (maximum 80%), as shown in Table 5. The cumulative percentage and RMS value for each attribute resulted in 4 out of 6 attributes that subsequently become the main leverages for sustainability, namely; (1) Efficiency of water usage (RMS-11.23 with cumulative 26.24%), (2) Ease of technology application (RMS -7.80 with cumulative 44.46%), (3) Network leakage (RMS-7.38 with cumulative 61.71%), (4) Quality of received water (RMS-7.15 with cumulative 78.41%), as shown in Figure 9.

**Leveraging Attributes in the Institutional Dimension**

A Leverage analysis was conducted to identify sensitive attributes in the Institutional Dimension. The results of the Leverage analysis on the attributes in the Institutional Dimension for the sustainability of the community-based drinking water provision program PAMSIMAS in Kapongan Sub-district are presented in Figure 10.

Results of the sustainability leveraging attribute analysis in the Institutional Dimension, based on the Pareto Optimum law (maximum 80%), as shown in Table 6, produced 3 attributes out of 6 attributes which further became the primary leverages for sustainability, namely; (1) Clear organizational structure (RMS-5.40 with a cumulative 43.87%), (2) Performance and financial reporting by the management to the users of the water supply system (RMS-2.37 with a cumulative 63.12%), (3) Regulations for water supply management (RMS-1.66 with a cumulative 76.60%), as shown in Figure 11.

**Validity of Analysis Results**

The results of the Rap-SPAM approach calculation across dimensions yielded stress values between 0.15 to 0.18 and $R^2$ values between 0.93 to 0.94, as presented in Table 7. Based on these S and $R^2$ values, following the criterion for statistical model analysis that a good model has S less than 0.25 and $R^2$ approaching 1 (Kavanagh and Pitcher, 2004), it can be concluded that the model examined in this research is good (good of fit) in terms of all dimensions. This indicates that all attributes for each dimension have accurately depicted the conditions in the community-based PAMSIMAS water supply systems in Kapongan Sub-district, hence there is no need for addition or reduction of attribute numbers.

Monte Carlo analysis in Rap-SPAM is used to examine the influence of errors in the scoring process of attributes due to limitations in information, the variation in scoring due to differences in opinions or assessments of attributes by each respondent, the stability of the MDS ordination process, and errors in data entry (Kavanagh, 2001). The conclusion of the analysis was drawn by comparing the difference between the ordination results in the Monte Carlo sustainability index and the MDS Sustainability Index, as presented in Table 8.

In this study, Monte Carlo analysis was conducted with 25 repetitions (iterations) within a 95% confidence interval, showing differences in the MDS index values compared to the Monte Carlo analysis of no more than 5%. This indicates that the sustainability index values in each dimension have a relatively small random error (Hardjomidjojo et al., 2016, in Munawir et al., 2022).

## Conclusion

From this research, it can be concluded that based on the 30 attributes from the 5 dimensions of sustainability, a total of 18 sensitive attributes or main leverage factors affecting the sustainability of community-based drinking water supply in the Pamsimas program in Kapongan Sub-district were identified.. All of these 18 main leverage factors significantly affect the index values of each sustainability dimension. The main leverage attributes in the environmental dimension are surrounding land conditions, pollution potential, rainfall & rainy days, and quantity of raw water. In the social dimension, the main leverage attributes are community meetings, practices of using the water supply system, and community trust. In the economic dimension, the main leverage attributes are existence of fees for the development of the water supply system network, availability of funds for the development of the water supply system, existence of user fees, and affordability of user fees. In the technology dimension, the main leverage attributes are efficiency of water usage, ease of technology application, network leakage, and quality of received water. In the institutional dimension, the main leverage attributes are clear organizational structure, performance and financial reporting by the management to the users of the water supply system, and regulations for water supply management.

## Suggestion

The findings of this research can serve as a basis for policy recommendations to enhance the sustainability of the PAMSIMAS program, which focuses on community-based water supply in the Kapongan Sub-district. These recommendations are formulated based on the assessment of specific attributes that significantly impact the sustainability level. Some attributes are identified as sensitive to sustainability, while others are considered less sensitive. The goal of these recommendations is to strengthen the factors influencing sustainability values, with the hope of promoting program advancement. In this context, the participation and commitment of local government and relevant stakeholders are crucial in reinforcing attributes that have a significant impact, thereby supporting the improvement of sustainability in community-based water supply through the PAMSIMAS program in the Kapongan Sub-district.

## References


Bappenas. (2020). *Metadata Indikator Edisi II, Pilar Pembangunan Lingkungan, Pelaksanaan Pencapaian Tujuan Pembangunan Berkelanjutan /Sustainable Development Goals (TPB/SDGs)*. Jakarta: Badan Perencanaan Pembangunan Nasional.

BPS Kabupaten Situbondo. (2021). *Kecamatan Kapongan Dalam Angka 2020*. Situbondo: Badan Pusat Statistik Kabupaten Situbondo.

BPS Kabupaten Situbondo. (2022). *Kecamatan Kapongan Dalam Angka 2021*. Situbondo: Badan Pusat Statistik Kabupaten Situbondo.

CPMU Pamsimas Secretariat. (2013). *Pedoman Pelaksanaan Program Pamsimas di Tingkat Masyarakat*. Jakarta Pusat

Djono, T.P.A. (2011). *Analisis Keberlanjutan Sistem Penyediaan Air Minum Pedesaan (Kajian Sistem Penyediaan Air Minum Berbasis Masyarakat di Kabupaten Karanganyar, Provinsi Jawa Tengah sebagai Model Generik Keberlanjutan Sistem Penyediaan Air Minum Pedesaan)*. Jakarta: Tesis, Program Pascasarjana Universitas Indonesia.

Fauzi, A. (2022). *Teknik Analisis Keberlanjutan*. Jakarta: Gramedia Pustaka Utama

Febrina, L. dan Ayuna, A. (2014). Studi Penurunan Kadar Besi (Fe) Dan Mangan (Mn) Dalam Air Tanah Menggunakan Saringan Keramik. *Jurnal Teknologi*, Vol. 7, No. 11.

Kavanagh, P. And Pitcher, T.J. (2004). *Implementing Microsoft Excel Software for Rapfish: A Technique for The Rapid Appraisal of Fisheries Status*. Canada: The Fisheries Centre, University of British Columbia.

Kavanagh, P. (2001). *RAPFISH Software Description (for Microsoft Excel). Rapid Appraisal for Fisheries (RAPFISH) Project*. Fisheries Center University of British Columbia; Vancouver.

Kamulyan, P. (2018). *Evaluasi Keberlanjutan Pengelolaan Sistem Penyediaan Air Minum Berbasis Masyarakat Di Kota Blitar*. Surabaya. Tesis, Program Pascasarjana Institut Teknologi Sepuluh November. Retrieved from https://repository.its.ac.id/49907/1/3115207808-Master_Thesis.pdf

Krisdhianto, A., dan Sembiring, E. (2016). Evaluasi Keberlanjutan Sistem Penyediaan Air Bersih Perdesaan Di Kecamatan Ledokombo Kabupaten Jember Provinsi Jawa Timur. *Jurnal Teknik Lingkungan*, Vol. 22, No.1, 21-30.

Munawir, A., Rusdiyanto, E., dan Nurhasanah. (2022). *Analisis Statistik Pengelolaan SDA dan Lingkungan Metode Penelitian Aplikasi Software MDS-Rapsettlement*. Tangerang Selatan: Universitas Terbuka.

Pamsimas. (2022). *Pedoman Umum Pamsimas.* Jakarta: Direktorat Jenderal Cipta Karya, Kementerian Pekerjaan Umum dan Perumahan Rakyat. Retrieved from https://pamsimas.pu.go.id/konten/p-1_pedoman-umum-2022.pdf

Priyono. (2016). *Metode Penelitian Kuantitatif*. Sidoarjo: Zifatama Publishing

Suheri, A., Kusmana, C., Purwanto, MYJ., dan Setiawan, Y. (2020). Clean Water Supply Development Model in Sentul City. *Jurnal Mimbar*, Vol. 36 No. 2: 259-270. DOI: https://doi.org/10.29313/mimbar.v36i2.5116

Soesanta, P.E. (2013). Penanggulangan Kemiskinan Melalui Program Nasional Pemberdayaan Masyarakat (PNPM) Mandiri Perdesaan. *Jurnal Bina Praja*, Vol. 5 No. 2:73-78. DOI: https://doi.org/10.21787/jbp.05.2013.73-78

Swastomo, A.S., dan Iskandar, D.A. (2021). Keberlanjutan Sistem Penyediaan Air Minum Pedesaan Berbasis Masyarakat. *Jurnal Litbang Sukowati*, Vol. 4, No. 2, 14-27. DOI: https://doi.org/10.32630/sukowati.v4i2.131

Yusuf, M., Wijaya, M. Surya, R.A., dan Taufik, I. (2021). *MDS-RAPS Teknik Analisis Keberlanjutan*. Makassar: CV. Tohar Media.