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EVALUATION OF ENVIRONMENTAL QUALITY STATUS IN THE ACHIEVEMENT OF THE SUSTAINABLE DEVELOPMENT GOALS (SDGs) IN JEMBER REGENCY USING INTERPRETATIVE STRUCTURAL MODELLING

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Abstract: The sustainability of development in Indonesia is evaluated using the Environmental Quality Index (EQI). The EQI values obtained have the potential to impact the achievement of the Sustainable Development Goals (SDGs). This research aims to evaluate EQI achievements that support the recommendations for improving SDGs environmental goals 6, 11, and 15 through Interpretive Structural Modelling (ISM). The research approach employs quantitative descriptive methods, ISM analysis, and in-depth interviews with experts from related government agencies. The results show that the achievement of the environmental SDGs in the Jember Regency is relatively low and is dominated by SDGs 6. The recommendations based on the ISM analysis method are that six elements should be studied together with key sub-elements, forming a structured communication pattern. In addition, a Watershed Forum or Forum DAS training in river management should be the main program implemented, with the main indicator being the availability of human resources who understand the maintenance of environmental sustainability. The main aim of this would be to increase the role of society in managing water resources so that optimisation of water resources management can achieve environmental sustainability.

Keywords: Environmental assessment development, Interpretive Structural Modelling (ISM), sustainability.

Introduction

The Environmental Quality Index (EQI) is a national performance indicator in environmental management, used as a source of information to support policy-making regarding environmental protection and management. The Ministry of Environment and Forestry developed the EQI based on a quantitative assessment of the situation in Indonesia. The indicators used in calculating the EQI are the Water Quality Index (WQI), Air Quality Index (AQI), and Land Cover Quality Index (LCQI) (Adinugroho *et al*., 2022). The related achievement values are used as standards in policy-making concerning the management and protection of environmental quality. The thresholds are determined by Ministerial Regulation No. 27 of 2021. The EQI value for Jember Regency in 2023 was 67.7, considered in the medium category, falling short of the predetermined target of 70. The value has experienced a decline from 2020 of as much as 11.96 and did not meet the national EQI target. This situation indicates a fall in certain variables or indicators, resulting in a fall in the EQI value (Jember Regency Environmental Service, 2022).

In the achievement implementation report Sustainable Development Goals (SDGs) 2021, the Ministry of National Development Planning/ Bappenas made the value of EQI one of the indicators for the achievement of the SDGs, a global program approved by the United Nations (UN) on 25 September 2015. The program aims to encourage sustainable development, including improving the economy and community welfare, preserving the environment and social life, and

ensuring the implementation of regulations that support the sustainable development of the quality of life (Medina-Hernández & Fernández-Gómez, 2024). Jember Regency's SDG achievements include four development goals or pillars and 17 SDG targets. The environmental development pillar or goal is one of the pillars of development on which a report is made on the EQI indicator as part of SDG 6 (Clean Water and Decent Sanitation). A report is made on the value of the EQI indicator, namely the Water Quality Index (WQI), about water quality improvement. In SDG 11 (Sustainable Cities and Settlements), a report is also made on the value of the EQI indicator; in this case, the Air Quality Index (AQI) related to improving air quality.

In SDG 15 (Land Ecosystems), the report refers to the Land Cover Quality Index (LCQI) indicator; a decrease follows an increase in forest cover in deforestation. The use of EQI values as an indicator of SDGs achievement is linked to the maintenance of SDGs goals 6, 11, and 15. So, if the decline mark indicator is on EQI, this will impact the achievement of the SDG targets. The occurrence of natural disasters such as floods, increasing populations, pollution phenomena, land conversion, and emissions from the use of fossil fuels are factors that reduce the quality of the environment. Assessment of the status of environmental quality is therefore, an important factor in supporting the realisation of the SDGs (Qa A'yun & Tiyaningsih, 2023; Kikuchi, 2023; Liu *et al*., 2023).

Achievements assessment of the environmental development pillars or goals with indications of WQI, AQI, and LCQI in Jember Regency is considered to be in a fairly low category, at 20%. The measuring of the level of achievement of SDG targets must include indicators and data availability. Currently, synchronising the assessment of environmental quality status with the achievement of SDG targets on environmental goals or pillars is not done. It is still considered separately and not integrated as an evaluation of performance achievements of Sustainable Development Goals. The development of sustainability evaluation theory, which includes the Environmental Sustainability Index (ESI), Environmental Performance Index (EPI), and the Virginia Environmental Quality Index (VEQI) is a reference for synchronisation of the application of EQI tools with the achievement of SDGs (Indonesian Ministry of Environment, 2012).

Evaluation tools produce methods for assessing environmental quality status in the form of indexation and are included in Indonesian regulations. The indexation method can represent multi-criteria indicators into values equipped with objective-based informative conclusion categories (Li & Wang, 2022; Wu *et al*., 2023). This research aims to assess the linkages and achievements of EQI in supporting SDG pillars or goals 6, 11, and 15 and to make recommendations for strategies for improving the SDG environmental pillars (6, 11, and 15) by using the Interpretive Structural Modelling (ISM) method. This technique indicates specific relationships between variables in a comprehensive structure whose output comprises a graphical model in the form of quadrants and variable levels (Ardeshiry *et al*., 2023).

Materials and Methods

Tools and Materials

The research tools were the authorised Regional Apparatus Organisation (RAO) Questionnaires, the Expert Questionnaire, Microsoft Excel 2016, and Exsimpro-ISM software. The materials employed comprised data from the Water Quality Index (WQI), Air Quality Index (AQI), and Land Cover Quality Index (LCQI), taken from the Strategic Environmental Study—Regional Medium-Term Development Plan document (KLHS RPJMD) 2021-2026 Jember Regency.

Research Methods

(1) Clustering

The clustering of SDGs achievement criteria in the Jember Regency Environmental Development Pillars or Goals of SDGs indicators was conducted using descriptive analysis by grouping relatively homogeneous SDGs based on the EQI indicator variables considered for the analysis of the Jember Regency Environmental Quality Index (EQI) indicator data. The research methods are only applicable in the Indonesian region. The EQI tool is developed based on characteristics, regulations, and data available in the province. It was developed by the Indonesian Ministry of Environment, which cooperates with the Danish International Development Agency (DANIDA) to achieve provincial-level environmental quality status (Indonesian Ministry of Environment, 2012).

(2) Recapitulation and Tabulation

The questionnaire data were assessed using a Likert scale. Such a scale method can be used to measure perceptions as it has a concise form, making it easier for respondents to answer each instrument item (Dogan *et al*., 2023). The development issue questionnaire values obtained were interpreted based on the categories presented in Table 1. The data results were presented in tabular form to provide a clear and structured visualisation of the complex information regarding the organised data results by calculating the percentage score using Formula 1.

Table 1: Score categories

No.	Category	Score
1	Strongly agree	5
2	Agree	4
3	Neutral	3
4	Disagree	2
5	Strongly disagree	1

$$\text{Score Percentage} = \frac{score\ total}{maximum\ score} \times 100\% \quad (1)$$

(3) Frequency Distribution

The percentage score results were obtained by analysing the respondents' presentative frequencies presented in the score table. The measurement of the percentage of environmental development issues in the SDGs Environmental Pillar achievements and the frequency distribution results were classified into interval categories based on the criteria presented in Table 2. After obtaining the frequency value based on the interval class, the relative frequency calculation was performed using Formula 2.

Table 2: Interval categories

No.	Interval	Category
1	80 < SCORE ≤ 100	Very low
2	60 < SCORE ≤ 80	Low
3	40 < SCORE ≤ 60	Average
4	20 < SCORE ≤ 40	High
5	≤ 20	Very high

$$fr = \frac{f}{N} \times 100\% \quad (2)$$

where f: Frequency
N: Total respondents

(4) Interpretative Structural Modelling (ISM) Analysis

The ISM modelling technique is a system approach that is used in operational research or descriptive statistical applications. The study data were collected from interviews with the various parties involved. Each sub-element of the elements studies was placed in a hierarchy and classified into sectors to determine variables. The classification referred to autonomous (sector 1), dependent (sector 2), linked/linkage (sector 3), and independent (sector 4) research (Timmerman *et al.*, 2022).

(a) Hierarchy Arrangement

Establishing contextual relationships between sub-elements, which contain a direction in sub-ordinate terminology, leads to pairwise comparisons by experts/ stakeholders.

(b) Preparation of Structural Self-Interaction Matrix (SSIM) Tables

Contextual relationships were presented in variables, which are contextually related by making variables i and j. It is then presented in the form of a Structural Self-Interaction Matrix (SSIM) using the VAXO symbol.

(c) Creating a Reachability Matrix (RM) Table

After the SSIM was formed, the symbols V, A, X, and O were converted into binary matrix form numbers ('0' and '1').

(d) Creating a Canonical Matrix

The next step is to calculate the transitivity rules by creating a canonical matrix to determine the level through iteration. When there are no more intersections, ISM creates a model to solve the problem. From this model, a road map for institutional development (level) was created. Further processing of the reachability matrix, which meets the transitivity rules, included the determination of level partition options. Processing was conducted using *Exsimpro* software. Based on the choice of levels, the scheme of each element could be drawn according to vertical or horizontal levels. For various sub-elements in an element based on RM, driver power dependence is arranged. The sub-element classification is described in the following four sectors (Setiawan & Suhirman, 2023):

Sector 1: Weak driver-weak dependent variables (AUTONOMOUS). Changes in this sector are generally not related to the system and may have a weak relationship, although this can also be strong.

Sector 2: Weak driver-strongly dependent variables (DEPENDENT). Generally, changes in this case are not free.

Sector 3: Strong driver-strongly dependent variables (LINKAGE). Variables in this sector must be studied carefully because the relationship between them is unstable. Each action on this variable has an impact on others and the feedback effect can strengthen the impact.

Sector 4: Strong driver-weak dependent variables (INDEPENDENT). Variables in this sector comprise the remaining part of the system and are called independent variables. Figure 1 shows an image of the canonical matrix.

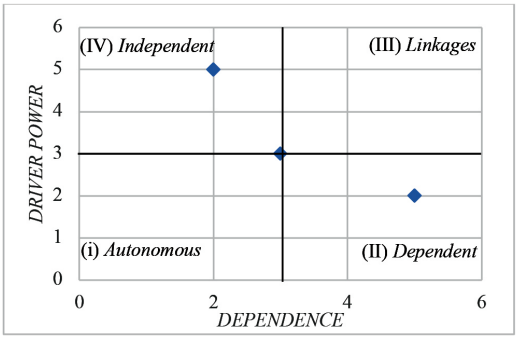

Figure 1: Canonical matrix

Results and Discussion

Evaluation of Jember Regency's EQI Achievements Concerning the SDGs Environmental Development Pillars

The indicators used in calculating the Environmental Quality Index (EQI) were the Water Quality Index (WQI), Air Quality Index (AQI), and Land Cover Quality Index (LCQI) (Ministry of Environment and Forestry, 2020). These values are used as an indicator in policymaking regarding processing issues and protecting environmental quality. The threshold is determined by the Minister of Forestry Regulation of the Republic of Indonesia Number 27 of 2021 concerning the Environmental Quality Index. Table 3 presents data on the EQI values for Jember Regency for 2015 to 2023 years.

The graph of the Jember Regency EQI value for 2013 to 2023 shown in Figure 2 indicates that there was fluctuation, with increases and decreases in these nine years. This significant decline in the EQI value in 2020 to 2023 was influenced by various factors, including environmental conditions and community behaviour, so sustainable environmental development was not achieved optimally. According to the SDGs

Table 3: EQI value data 2015 to 2023

Year	AQI	Category (AQI)	WQI	Category (WQI)	LCQI	Category (LCQI)	EQI	Category (EQI)
2015	45.85	Poor	68.57	Medium	68.87	Medium	61.87	Medium
2016	70.55	Good	51	Medium	77.43	Good	67.44	Medium
2017	77.03	Good	50	Medium	77.44	Good	69.08	Medium
2018	76.83	Good	51.11	Medium	77.46	Good	69.37	Medium
2019	81.44	Good	50	Medium	77.46	Good	70.42	Good
2020	80.57	Good	67.78	Medium	77.46	Good	75.08	Good
2021	82.21	Good	50	Medium	50.33	Medium	63.12	Medium
2022	82.89	Good	65.65	Medium	50.67	Medium	69.35	Medium
2023	85.96	Good	56.67	Medium	52.87	Medium	67.7	Medium

Source: Jember Regency Environmental Service (2024)

implementation and achievement report in the KLHS RPJMD Jember Regency 2021-2026 document, improving the achievement of Jember Regency's SDGs on the Environmental Development Pillar is still not optimal. In the report on the implementation and achievement of the SDGs by the Ministry of National Development Planning/Bappenas, in SDGs 6, there is a report on the EQI indicator value, namely IKA, regarding improvement in water quality; in SDGs 11, there is a report on the AQI indicator value regarding air pollution in urban areas; and in SDGs 15 there is a report on the LCQI value regarding cover forests and deforestation. Efforts to increase the targets of the SDGs in the Environmental Pillar are a priority in national development, as well as improving environmental quality, which requires planning policy synergy at the national, provincial, and district/city levels.

The SDGs targets at the Jember Regency regional level are in line with the 2021-2026 Regional Medium-Term Development Plan (RMTDP or RPJMD), in the form of programs, activities, and measurable indicators, together with indications of financial support. Mapping of SDGs targets and indicators against EQI was performed to integrate unachieved SDGs targets and indicators into EQI development (Figure 3), which shows a percentage diagram of the results of identifying the achievement of the Environmental Pillar SDGs towards EQI. Based on Figure 3, the achievement results show information on the influence factors provided by the authorised Regional Apparatus Organisations, as presented in Table 4.

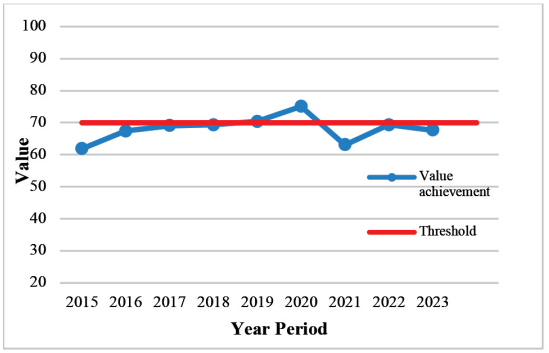

Figure 2: Graph of EQI values (2015-2023)
Source: Jember Regency Environmental Service (2024)

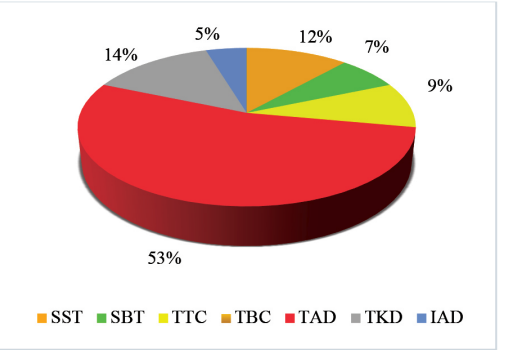

Figure 3: Percentage of achievement of SDGs environmental pillars

Table 4: Description of environmental pillar achievements

Code	Information	Description of Factors Based on RAO
SST	It has been implemented and has achieved the national target	-
SBT	It has been implemented, but it has not yet reached the national target	Present programs are not optimal due to limited human resources in the scope of program implementation, management, and maintenance
TTC	There was no regional target, but it was achieved	-
TBC	There are no regional targets and they have not been achieved	Limited Regional Government budgets for program implementation
TAD	No data yet	The program was planned but was not implemented due to Regional Government budget limitations
		The program is already running, but RAO does not provide program achievement data to the Development Planning Agency at the Sub-national Level, so these are not included in Jember Regency SDGs achievements
TKD	Not yet by regional characteristics	The program does not match the characteristics of the region, but the indicators still follow the National Medium-Term Development Plan (NMTDP or RPJMN)
IAD	Global indicators that have proxies will be developed	-

Analysis of the Linkage of EQI Indicators to the Environmental Pillar Sustainable Development Goals

The SDGs Environmental Pillars, namely SDGs 6, 11, and 15 conducted an inventory of environmental development programs in the KLHS RPJMD Jember Regency 2021-2026 to identify SDG development issues that influence the development of EQI Jember Regency. The study's results and information from the authorised RAO implementing the environmental development program were used to analyse development issues.

SDGs 6: Development Issues (Clean Water and Adequate Sanitation) in the Water Quality Index

WQI functions to determine the value of water quality in the Jember Regency. River water quality is measured using the Water Quality Index (WQI) and the Pollution Index (IP) method. The IP value obtained is multiplied by the level of the water quality status to obtain the Water Quality Index (WQI) value (Artiningrum & Saeful, 2023). Figure 4 shows the results of the calculation of the Jember Regency Water Quality Index (WQI) for the nine years from 2015 to 2023.

The figure shows that there were increases and decreases over the nine years period; the lowest WQI values occurred in 2021 and 2023, namely 50 and 56.67, which are in the medium category. According to Minister of Environment and Forestry Regulation No. 27 of 2021, the quality standard used for the WQI is class II quality standard PP No. 22 of 2021. Analysis of the water quality parameters in Jember Regency from 2018 to 2022 shows that DO levels exceeded class II quality standards,

namely > 4 mg/L. This is caused by the river profile and the amount of organic pollutants in the water, which affect dissolved oxygen levels (Novita *et al*., 2024). The failure to achieve the WQI value is influenced by environmental development in terms of the provision of clean water and sanitation, which is currently done by linking most of the achievements of the SDGs indicators to the Environmental Quality Index indicators. Figure 5 shows a diagram of aspects of the environmental development program in Jember Regency that were not achieved.

Based on the results of the achievement evaluation, it was found that several environmental development programs related to SDG 6 could influence the WQI value, so questionnaires were distributed to RAOs who had authority over program implementation. Figure 6 shows data on the frequency of respondents regarding the development

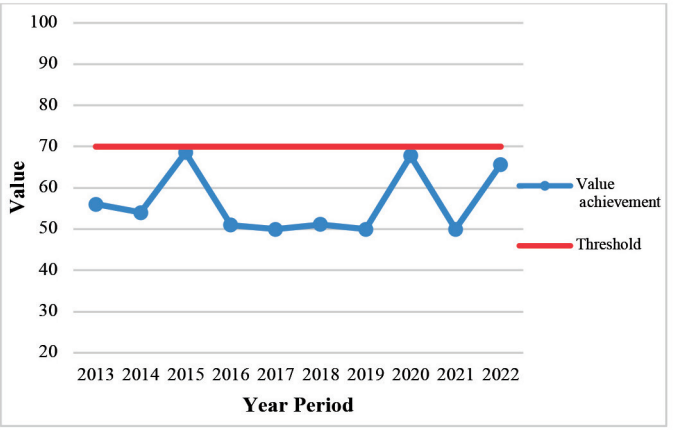

Figure 4: Graph of WQI values for Jember Regency

Source: Jember Regency Environmental Service (2024)

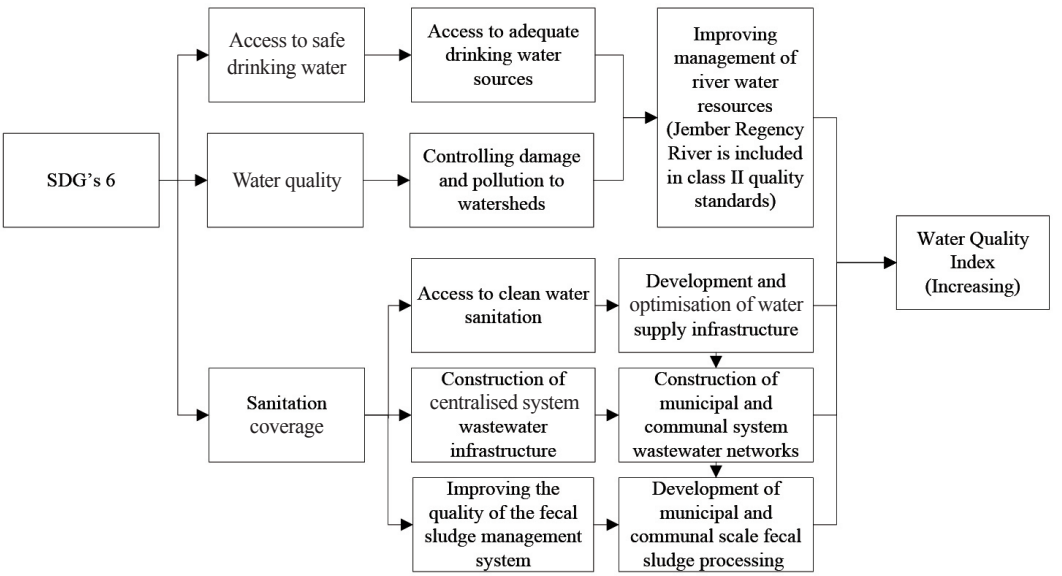

Figure 5: SDGs 6 strategic work program diagram

issue of SDG 6 (Clean Water and Decent Sanitation) on the Water Quality Index. Figure 6 shows that 85% of respondents stated that the development of a clean water environment and proper sanitation was very poor, 15% said that it was insufficient, indicating a clear issue of SDG 6 development not being achieved/ implemented in WQI. This was influenced by the development of a centralised wastewater infrastructure on a city, regional, or communal scale not being achieved in Jember Regency. Water resource processing in Jember Regency is in moderate condition if considered by the physical dimension of the environment; there is a high percentage (22.12%) of households without a place to defecate and another 0.19% do not use defecation facilities. Perumdam Tirta Pandalungan as the Municipal Water Works in Jember Regency uses potential sources of clean water from the Bedadung River, one of the largest rivers in Jember Regency while the water quality in Jember Regency in 2018 to 2022 showed that the DO parameter exceeded class II quality standards (Indarto *et al*., 2023).

This states that environmental development activities in terms of clean water and proper sanitation in the Jember Regency are still at a relatively low level, leading to low WQI. Therefore, it is necessary to develop an equitable clean water sanitation infrastructure and improve the management of river water resources so that they are acceptable to the community and meet the requirements for conservation and environmental carrying capacity, which will consequently increase the quantity and quality of clean water (Nurhidayah *et al.*, 2023).

SDGs 11: Development Issues (Sustainable Cities and Settlements) on the Air Quality Index

One resource that must be protected from damage and pollution is air; clean air is an indicator of a healthy district/city (Wang *et al*., 2023). According to Minister of Environment and Forestry Regulation No. 27 of 2021, air quality monitoring is performed at least twice a year. The results of measuring the Air Quality Index (AQI) values are categorised according to the index category. Figure 7 shows the Air Quality Index values for Jember Regency for 2015 to 2023. The figure indicates that there have been fluctuations in the Air Quality Index values in the regency; the value for 2023 was the highest for the last nine years. This demonstrates that the air quality in Jember Regency is still relatively good (meeting environmental quality standards). This is in line with the Clean Air Initiative program, developed by the Ministry of Environment and Forestry, aimed at improving air quality in Indonesia. The program includes

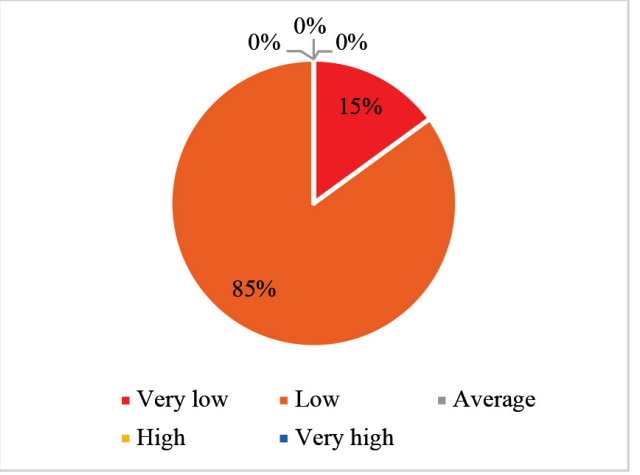

Figure 6: Frequency diagram of SDGs development issues regarding WQI

several activities, including outreach to increase public awareness of the importance of maintaining air quality. The Indonesian government has taken major steps in addressing the problem of air pollution as part of the implementation of the SDGs (Syuhada *et al.*, 2023). However, the people of Jember Regency still have the habit of burning rubbish, especially those who live in rural areas, which can cause a decrease in air quality. Figure 8 shows data on the frequency distribution of respondents regarding the development issue of SDGs 11 on the Air Quality Index.

Figure 8 indicates that the frequency of SDG 11 development issues that have not been achieved/implemented regarding the Air Quality Index is quite low, with 80% in the medium category and 20% in the low category. Based on the results of the study, several development issues that fall into the moderate category are shown to have been caused by the lack of development of city concepts designed to consider their impact on the environment or green spaces. City development in Jember Regency tends to pay little attention to the concept of green space; areas covered with

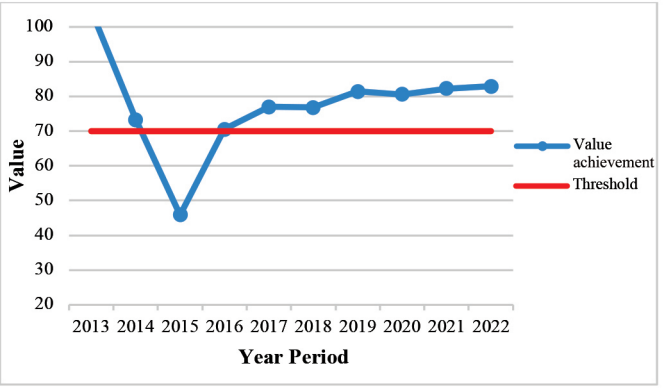

Figure 7: Graph of AQI values for Jember Regency
Source: Jember Regency Environmental Service (2024)

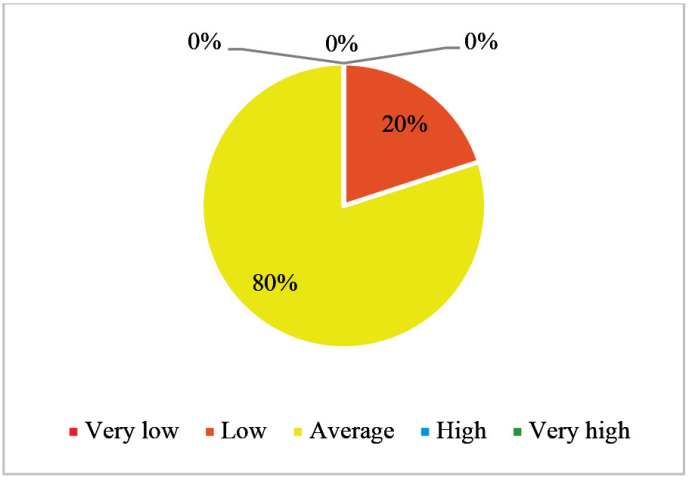

Figure 8: Frequency of SDGs 11 development issues regarding AQI

trees are converted into trading zones, an example of which is a city area being Jl. Java, Sumbersari Village, Sumbersari District. The urban environment is developing economically but declining ecologically, thereby disrupting the balance of the urban ecosystem, which is characterised by issues such as rising temperatures and air pollution, falling land levels, and an increasing danger of flooding. This reduces the productivity of economic activities and disrupts the comfort of urban life.

SDGs 15: (Land Ecosystem) Development Issues on the Land Cover Quality Index (LCQI)

Minister of Environment and Forestry Regulation No. 27 Year. 2021 concerning EQI, green open space, including land cover is included in the calculation of the Land Cover Quality Index (LCQI). In addition, forest cover, shrubs, and forest and land rehabilitation are also included in the calculation of the LCQI. Jember Regency obtained LCQI scores for 10 years from 2013 to 2022; Figure 9 shows a graph of these values.

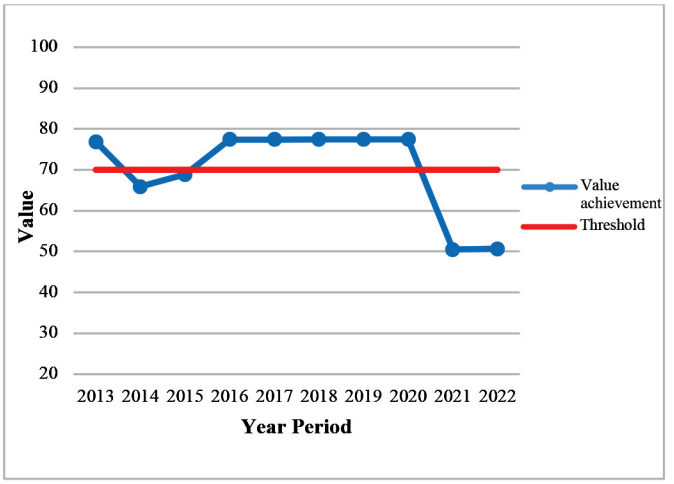

Figure 9: Graph of Jember Regency LCQI values
Source: Jember Regency Environmental Service (2024)

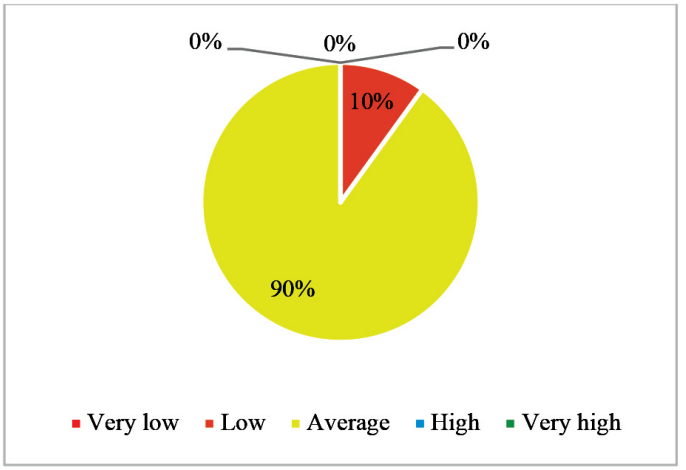

Figure 10: Frequency of SDGs 15 development issues regarding LCQI

The graph shows a quite significant decline in the period 2021 to 2023, namely a value of 52.87. This was influenced by the failure to implement environmental development that took into account forest preservation. Figure 10 shows data on the frequency distribution of questionnaire results regarding SDG 15 development issues on the Land Cover Quality Index.

In the pie chart, it can be seen that there is quite a high frequency of SDG 15 development issues that have not been achieved/implemented regarding the LCQI, with 90% in the medium category and 10% in the high category. Based on the results of the study, this was caused by population growth, which resulted in increased food needs and community productivity, in addition to the quality of land cover in the Jember Regency. Changes are still being made to forest areas and land covered by trees, especially ones caused by illegal activities such as illegal logging, then, there is critical land in Jember Regency due to activities undertaken by the community and the rehabilitation of critical land which has not been done optimally. However, the Regional Government cannot implement it fully because Government Regulation No. 23 of 2021, which regulates forestry implementation is carried out directly by the Provincial Government.

Determination of Program Recommendations with Interpretative Structural Modelling (ISM)

Based on the data on environmental development issues obtained and the findings from interviews with the authorised RAO, recommendations for development programs for EQI achievement in the implementation of the SDGs in Jember Regency will be determined using the Interpretative Structural Modelling (ISM) method, which provides the results of discourse and structural mapping in the complex interrelationship between sub-elements in six elements.

In addition, questionnaires were distributed to experts/stakeholders from the Department of Public Housing, Settlement Areas and Human Settlements; the Department of Highways and Water Resources; the Department of the Environment; and the Jember University SDGs Center Team, all of whom were managing the regional development of Jember Regency in 2018. The ISM method was implemented for each indicator/sub-element. Six elements were defined: Needs, constraints, goals, indicators, programs, and institutions. The results of ISM analysis using Driver Power (DP) and Dependence (D) values, followed by ISM analysis mapping the DP-D matrix, can be arranged by placing each coordinate (x, y). The five elements needed in the EQI achievement strategy for implementing the SDGs are shown in Table 5.

The results of the ISM processing for the requirement elements are presented in Figure 11. This shows that among the need sub-elements to determine strategies for achieving EQI for the implementation of SDGs in Jember Regency, the key sub-elements are regional regulations regarding the prevention of declines in river water quality (B3) and professional Human Resources (HR) (B4). The Requirements Element Matrix is presented in Figure 12. The matrix shows that the key sub-elements contained within it are in the top position, with the highest driving power value at coordinates

Table 5: Need sub-elements

Code	Need Sub-elements
B1	Development of wastewater management on a city, regional, and communal scale
B2	Faecal sludge management is implemented in all sizes of households
B3	Regional regulations regarding the prevention of a decline in river water quality
B4	Professional HR
B5	Development of sustainable sanitation infrastructure and clean water

(2.6) in quadrant IV of the independent sector, namely regional regulations regarding the prevention of declining river water quality (B3) and professional HR (B4), which shows that this sub-element system does not depend on other sub-elements and plays an important role in meeting the needs to achieve environmental development so that it can increase the value of EQI. This can be achieved because the government guarantees the protection of water resources and community empowerment in its efforts to maintain sanitation facilities and infrastructure and water conservation, which emphasises aspects of ecological and social functions in water management so that clean water can be guaranteed. Factors that are important in the sustainability of the condition and function of watershed utilisation are the rules/regulations that underlie watershed management so that sustainable management can run optimally (Sulistyaningsih *et al.*, 2021).

Quadrant III of the linkage sector includes the development of wastewater management on a city, regional, and communal scale (B1), meaning that this sub-element is a strong driving force in achieving the increased EQI value of Jember Regency. However, careful consideration of this is needed because even though it is a strong driving force, this element also has high dependence or interdependence on other elements. Relationships between sub-elements may be unstable, so actions on one sub-element may impact other sub-elements, with feedback effects that could strengthen the impact (Sulandari *et al*., 2021).

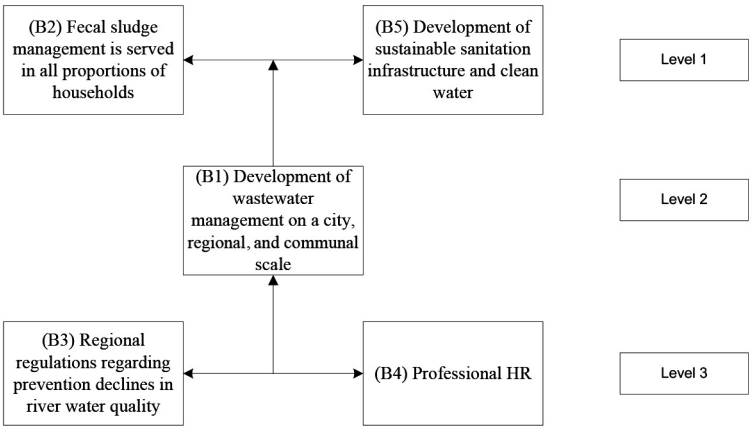

Figure 11: Sub-element requirements hierarchy diagram

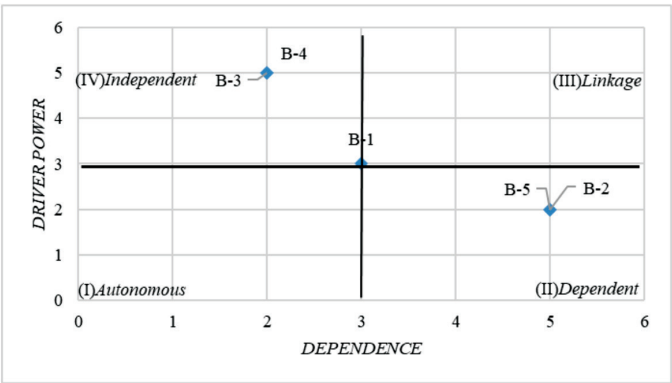

Figure 12: DP-D matrix of needed elements

The sub-elements included in quadrant II of the dependence sector are faecal sludge management provided to all size of households (B2) and the development of sustainable sanitation infrastructure and clean water (B5), meaning that the driving force in meeting the need to increase the achievement of EQI values is weak because the values it achieved are very low. Faecal sludge management and the development of sustainable sanitation infrastructure can be implemented, but this depends on the implementation of sub-elements that have higher driving power values. Constraint sub-elements are elements of obstacles to the EQI achievement strategy in the implementation of the SDG and they are described in the five sub-elements presented in Table 6. The results of the ISM processing for the constraint elements are presented in Figure 13.

Table 6: Constraint sub-elements

Code	Constraint Sub-element
K1	A high percentage of households do not have a place to defecate
K2	Less than optimal management of water resources that considers environmental sustainability
K3	Low public awareness or concern for river management
K4	Less than optimal local government policies and programs for river management
K5	Budget limitations faced by the Regional Government
K6	The development of the clean water sanitation infrastructure has not been evenly distributed

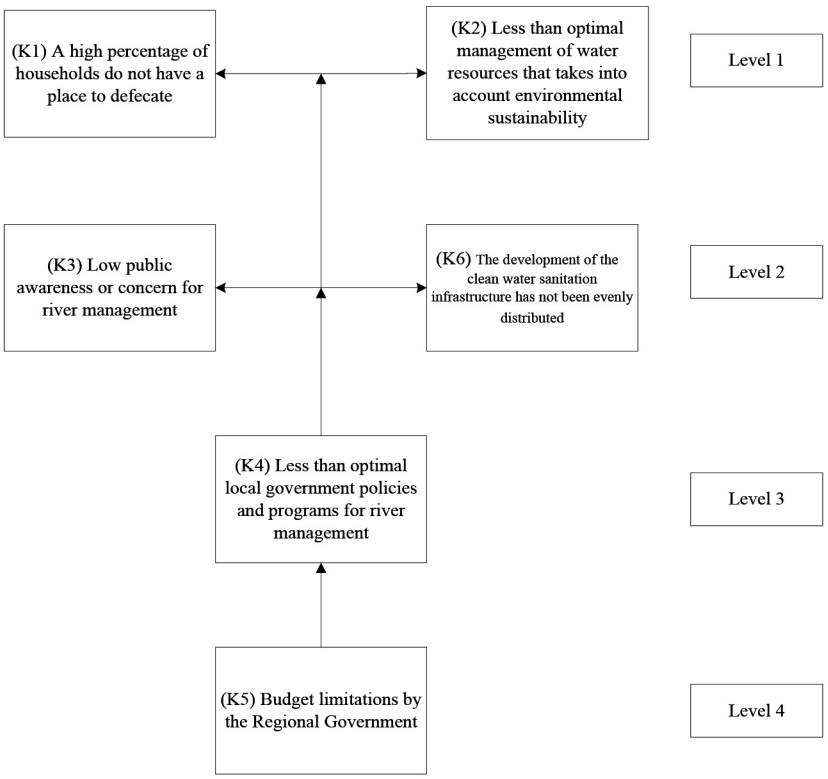

Figure 13: Constraint sub-element hierarchy diagram

The figure shows that in the constraint element in determining the EQI achievement strategy for implementing SDGs in the Jember Regency, the key constraint sub-element is budget limitations faced by the Regional Government (K5). Figure 14 presents a matrix of the constraint elements. The sub-element matrix shows that the key sub-elements in the matrix are in the top position, with the highest driving power values at coordinates (1.6) and (2.4) in quadrant IV of the independent sector, namely water sanitation infrastructure development. Cleanliness is not evenly distributed (K5) and less than optimal local government policies and programs for river management (K4), meaning that these sub-elements are included in an independent system and are not dependent on other sub-elements, but influence elements that have driving power values below them. In addition, this means that this sub-element is the main obstacle to improving the achievement of EQI values, optimal development, and optimal use of watershed resources to achieve the goals of conservation, poverty alleviation, and productivity. Therefore, the government can be facilitated collectively (Basuki *et al.*, 2022).

In quadrant III of the linkage sector, there are the sub-elements of low awareness or community concern for river management (K3) and the uneven development of clean water sanitation infrastructure (K6), which show that this sub-element has a strong driving force, but is dependent on other systems also being strong, meaning that resolving this obstacle requires in-depth study. In addition, the sub-element that is included in quadrant II of the dependence sector is the high percentage of households that do not have a place to defecate (K1) and the less optimal management of water resources that considers environmental sustainability (K2), meaning that this sub-element has a system that is not independent; that is, it is dependent on other sub-elements. Obstacles in this quadrant can be resolved if the constraint sub-elements that have higher DP-D values have been resolved (Rahmila *et al.*, 2023).

The elements of goals in the EQI achievement strategy for implementing the SDGs are described in five sub-elements presented in Table 7. Figure 15 shows that in the objective element of determining the EQI achievement strategy for the implementation of SDGs in Jember Regency, the key sub-elements are improving wastewater management on a city, regional, and communal scale (T1); optimising water resource management that considers environmental sustainability (T2); and increasing the role of communities in water resources management (T3). A matrix of goal elements is presented in Figure 16.

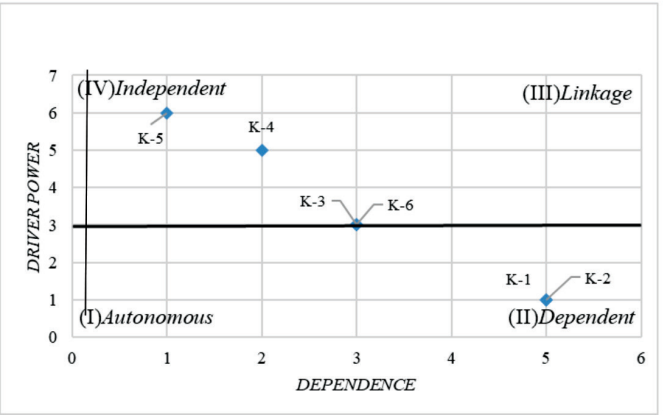

Figure 14: Constraint element matrix

Table 7: Goal sub-elements

Code	Goal Sub-element
T1	Improving wastewater management on a city, regional, and communal scale
T2	Optimising water resources management considers environmental sustainability
T3	Increasing the role of the community in managing water resources
T4	Internalisation of the Integrated Watershed Management Plan (RPDAST) into the Regional Spatial Space Document
T5	Increasing inclusive and sustainable economic growth
T6	Ensuring the availability and sustainable management of clean water and sanitation

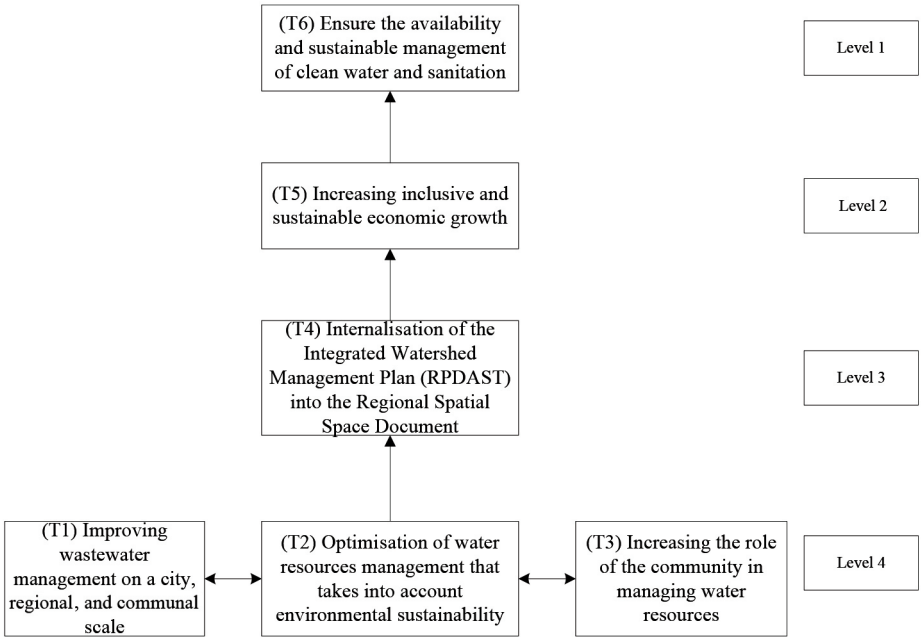

Figure 15: Goal element hierarchy diagram

The D-PD matrix in goal the sub-element element in Figure 16 shows that the key ones are in the top position, with the highest driving power value at coordinates (3.6) in quadrant IV of the independent sector, namely improving city-scale wastewater management, regional and communal (T1); optimising water resource management that considers environmental sustainability (T2); and increasing the role of the community in water resource management (T3). These three sub-elements are priority objectives in the strategy to increase the EQI value of the Jember Regency. The sub-element has an independent system and no dependency on other sub-elements. In addition, operating on a city and communal scale can reduce organic and non-organic pollutants contained in wastewater, disposing of them so that optimisation of water resources can be achieved and quality and sustainable sanitation can be created (Grabic, 2023).

In quadrant III of the linkage sector is located the internalisation of the Integrated Watershed Management Plan (RPDAST) into the Regional Spatial Space Document (T4). This means that this goal must be studied carefully because such internalisation will have an impact on other sub-elements and have a feedback effect that can

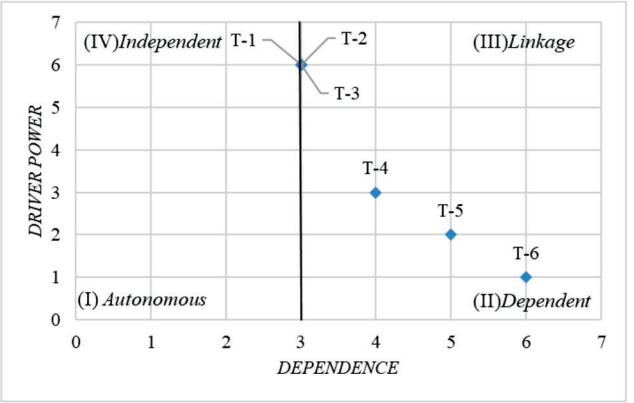

Figure 16: D-PD matrix of target elements

strengthen the impact of other goals. In addition, the sub-elements included in quadrant II of the dependent sector are increasing inclusive and sustainable green economic growth (T5) and ensuring the availability and management of clean water and sustainable sanitation (T6), which means that the system owned by this sub-element is not free from being achieved because it has a low driving power value and a high dependency value, meaning its achievement is influenced by other sub-elements that have a high driving power value.

The indicator elements in the EQI achievement strategy for implementing the SDGs are described in five sub-elements presented in Table 8. The results of the ISM processing for the goals elements are presented in Figure 17. The figure shows that the indicator element for determining the EQI achievement strategy for implementing the SDGs in Jember Regency, which is a key sub-element is the availability of human resources, who have knowledge, understanding, and enthusiasm for preserving the environment (I3). A matrix of indicator elements is presented in Figure 18. The key sub-elements in the DP-D matrix are in the top position, with the highest driving power values at coordinates (1.6) and (2.4) in quadrant IV of the independent sector, namely HR with knowledge, understanding, and enthusiasm for preserving the environment (I3) and watershed management that is performed in an integrated manner involving stakeholders, comprehensively and sustainably (I4). This shows that this sub-element is the main indicator in achieving the goal of increasing EQI value. Other sub-elements do not influence the sub-element but instead influence them. Quality human resources are needed for environmentally sound development or to continue to utilise natural resources optimally, taking into account the need to maintain environmental balance (Duc *et al*., 2022).

In quadrant III of the linkage sector, the sub-element of paying attention to environmental problems with inventories of river pollutant sources can be found (I5), which means that in achieving the objectives, this indicator must be studied carefully. Even though it has a driving force, this element also has a strong dependency. A close relationship with other elements or interdependency. Relationships between sub-elements may be unstable, meaning that actions on one sub-element can impact others, with feedback effects that can strengthen the impact. The sub-elements included in quadrant II of the dependent sector are the establishment of a city, regional, and communal scale wastewater management institutional structure (I1); the establishment of raw water facilities and infrastructure; households can use sanitation services safely; and a population that has management facilities. Sustainable water (I6) and balanced carrying capacity. The capacity for

development (I2) in this sector shows that the system that is owned is not free; when used as an indicator, the sub-element is dependent on and influenced by other indicator sub-elements.

Program Elements, the program elements in the EQI achievement strategy for implementing the SDGs are described in five sub-elements presented in Table 9. The results of the ISM

Table 8: Indicator Sub-elements

Code	Indicator Sub-elements
I1	Establishment of a wastewater management institutional structure on a city, regional, and communal scale
12	Balance the carrying capacity of the environment for development
13	Availability of human resources who have knowledge, understanding, and enthusiasm for preserving the environment
14	Watershed management is performed in an integrated manner involving stakeholders and comprehensively and sustainably
15	Attention should be paid to environmental problems by creating inventories of sources of river pollution
16	Develop raw water facilities and infrastructure; ensure households can use sanitation services safely; and ensure populations have sustainable water management facilities

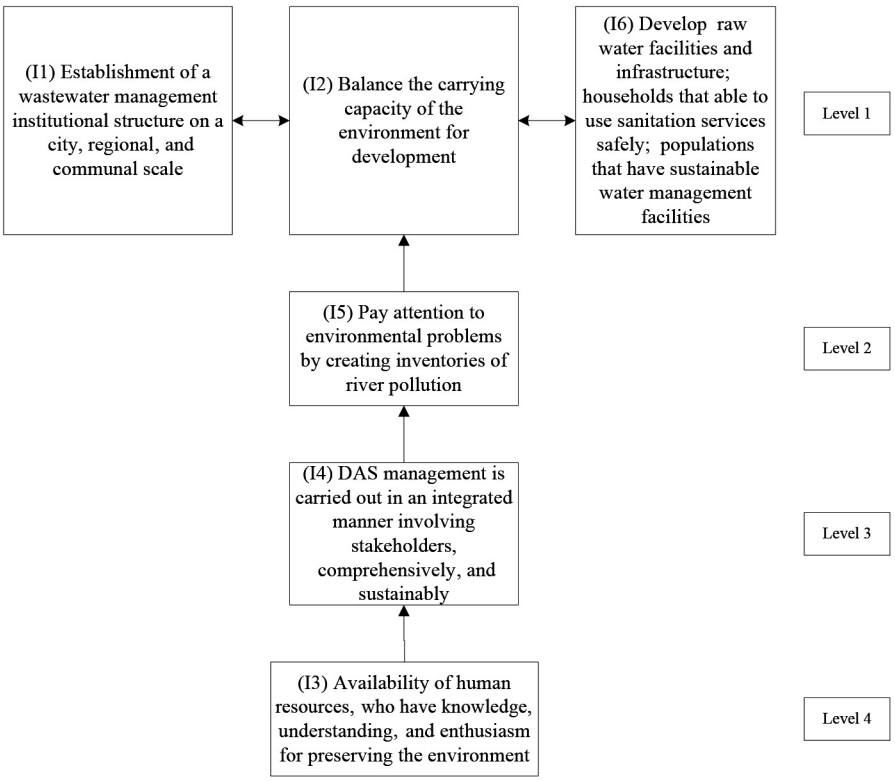

Figure 17: Indicator element hierarchy diagram

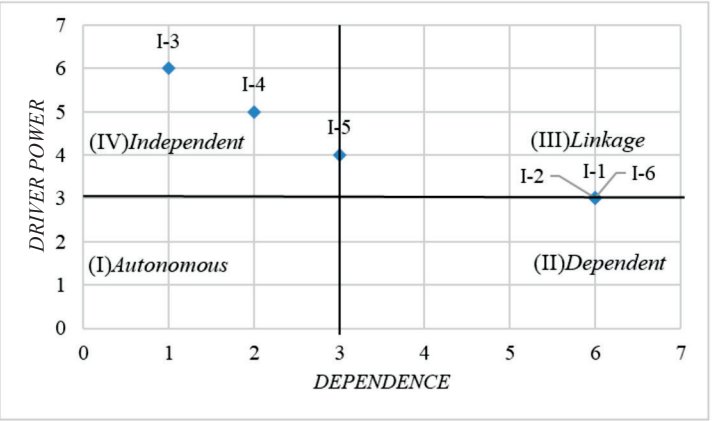

Figure 18: DP-D matrix of indicator elements

processing for the objective elements are presented in Figure 19. The figure shows that the program element of determining the EQI achievement strategy for the implementation of SDGs in Jember Regency, which is a key sub-element, includes the program of establishing a structured communication pattern and training for the DAS Forum in river management (P1). A matrix of program elements is presented in Figure 20. The sub-element program element matrix shows that the key sub-elements in the DP-D matrix are in the top position, with the highest driving power value for drivers at coordinates (2.6) in quadrant IV of the independent sector, namely forming a structured communication pattern and DAS Forum training in river management (P1). This indicates that this sub-element is a priority program in the strategy to increase the EQI value of Jember Regency because it has a high driving power value, so sub-elements do not influence it. The role of the community in water resources management is also very important, as they are stakeholders, who can influence the flexibility of sustainability water resources management from environmental, economic, and social perspectives (Eaton *et al.*, 2021).

In quadrant III of the linkage sector is located the sub-elements of design and development of watershed management as a clean water resource for Jember Regency (P2) and design and development of regional regulations to prevent a decline in river quality (P5). The program sub-elements contained in the sector are programs that have high influence

Table 9: Sub-program sub-elements

Code	Sub-elements of Programs/Activities
P1	Establish a structured communication pattern and training for the Forum DAS or Watershed Forum in river management
P2	Design and develop watershed management as a clean water resource for Jember Regency
P3	Provision of clean water sanitation infrastructure facilities
P4	Increase the role of the community in protecting the watershed environment
P5	Design and develop regional regulations to prevent a decline in river quality
P6	Implement a green economy so that economic development is in line with improving environmental quality

power as well as high. Because the system in the sector has a high driving power value and high dependence, to run the program on this sub-element, it is necessary to study it carefully; even though it has a strong power, it also has a high dependency against other elements or interdependence. Relationships between sub-elements may be unstable, so actions on one sub-element may impact other sub-elements, with feedback effects that can strengthen the impact (Maharani & Mellawati, 2021). Meanwhile, the sub-elements included in quadrant II of the dependence sector are the implementation of a green economy so that economic development is in line with improving environmental quality (P6), providing clean water sanitation infrastructure (P3), and increasing the role of the community in protecting the watershed environment (P4). This program is highly dependent on the running of other programs because the sub-elements in the dependence sector have low driving power values and high dependence, so the resulting system is not independent but dependent on the running of other program sub-elements.

Institutional Elements, institutional elements in the EQI achievement strategy for implementing the SDGs are described in five sub-elements presented in Table 10. The results of the ISM processing for the objective elements are presented in Figure 21. Figure 21 shows that in the institutional element for determining the EQI achievement strategy for the implementation of SDGs in the Jember Regency, the key institution sub-element is the Regency Government. This is then followed by the second key element, namely the community, which influences the authorised Regional Apparatus Organisations, which include the Public Works, Human Settlements and Public Housing Department, the Water Resources Highways Service, and Municipal Waterworks of Jember Regency (PDAM or Perumdam Tirta Pandalungan). A matrix of institutional elements is presented in Figure 22.

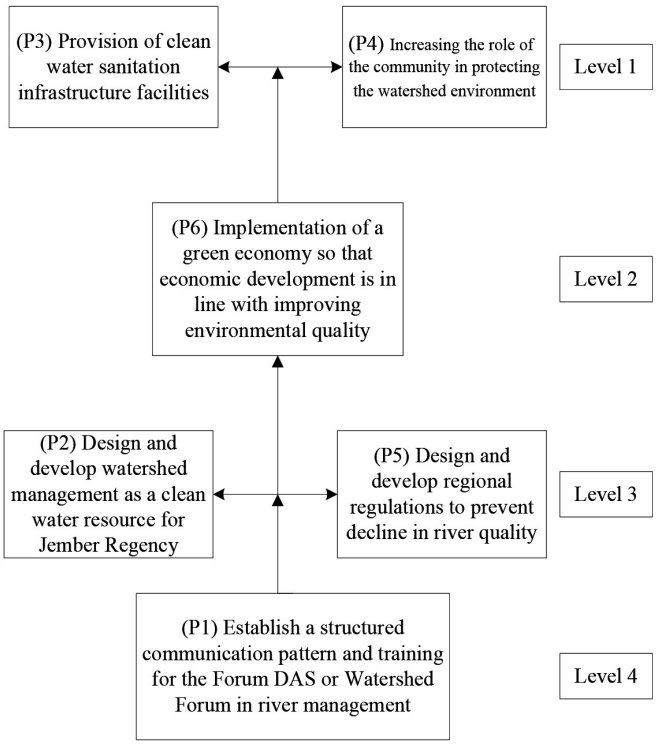

Figure 19: Hierarchy diagram of program elements

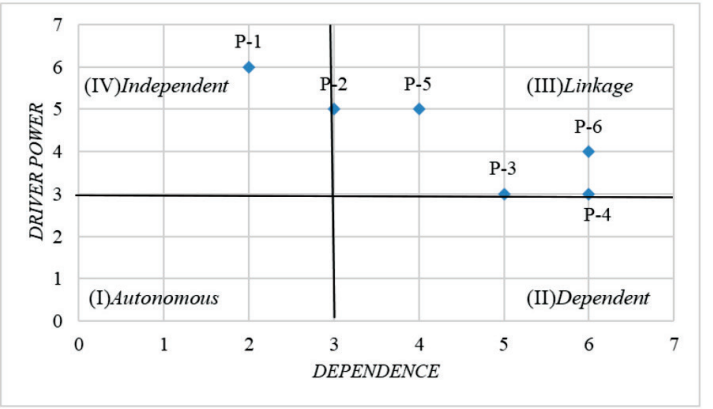

Figure 20: DP-D matrix of program elements

Table 10: Institution sub-elements

Code	Institution Sub-elements
L1	Regional Government/Jember Regency Government
L2	Public Works Department of Human Settlements and Public Housing
L3	Public Works Department of Human Settlements and Water Resources
L4	Perumdam Tirta Pandalungan as the Municipal Water Works
L5	Universities
L6	Public

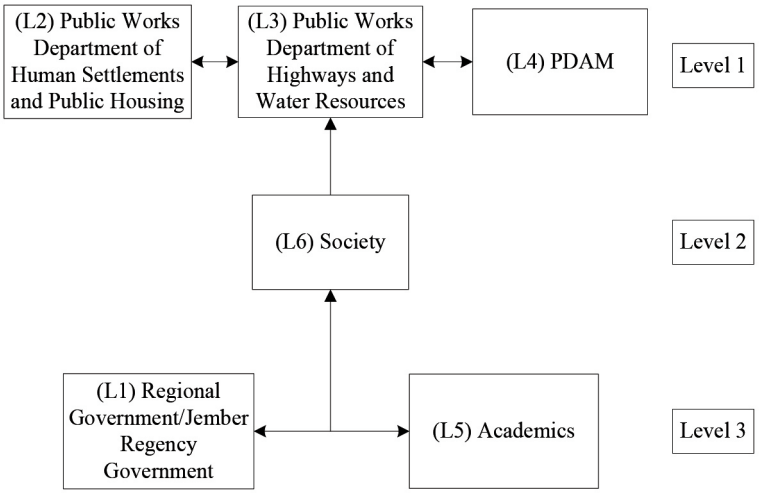

Figure 21: Hierarchy diagram of institutional elements

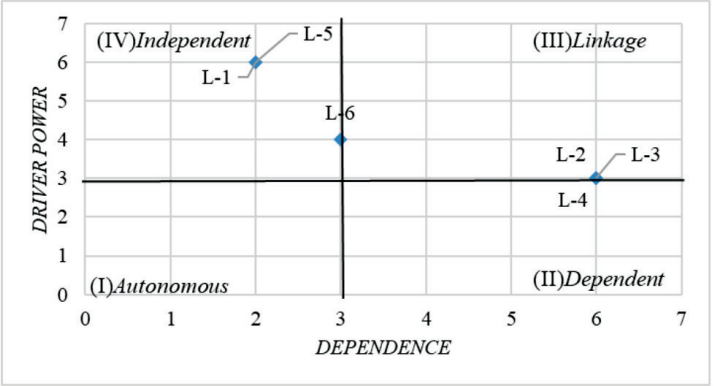

Figure 22: DP-D matrix of institutional elements

The key sub-elements in the DP-D matrix are in the top position, with the highest driving power value at coordinates (2.6) in quadrant IV of the independent sector, namely the Regional Government/Regency Government (L1) and Universities (L5). This shows that collaboration between the regional government and universities in planning strategies to increase the value of EQI through environmental development programs is the key to the success of environmental development in Jember Regency.

The policies launched by the government will largely determine the water resources management strategy (Mishra *et al.*, 2021). In quadrant III, the linkage sector is located in the society sub-element (L6). The community has high driving power and also a high dependence on participating in increasing the EQI value of Jember Regency through environmental development programs. This is because the position of the sub-element indicates a high driving power value and high dependence, so the sub-element of society (L6) needs to be studied carefully because the relationship between the elements is unstable. Sub-elements that are included in quadrant II of the dependent sector are the Public Works Department of Human Settlements and Public Housing (L2), the Public Works Department of Human Settlements and Water Resources (L3), and Municipal Water Works or PDAM – Perumdam Tirta Pandalungan (L4). Institutional sub-elements in this sector are policy-dependent on other institutional sub-elements. Stakeholders in water resources management play a very important role in gathering feedback from interactions with the community and related parties (Nagata *et al.*, 2022).

Key Sub-elements for Developing Program Recommendations

Based on the results of the data processing using the Interpretative Structural Modelling (ISM) method, it was concluded that the key sub-elements from the six elements studied were program recommendations to increase the value of EQI in achieving the SDGs. Table 11 shows the key sub-elements. In general, Table 11 presents the determination of the development of the main program recommendations. The results of these are expected to increase the EQI value of the Jember Regency in implementing the SDGs.

Conclusions

The results of the evaluation of the EQI scores in the Jember Regency have an influence on the achievement of SDGs for the Environmental Pillar, namely numbers 5, 11, and 15. The results are still relatively low, this is obtained by obtaining a still high percentage of No. Data (TAD) amounting to 53% in the KLHS

Table 11: Key sub-elements of program recommendations

Element	Key Sub-elements
Need	1. Regional regulations regarding preventing a decline in river water quality
	2. Professional HR
Constraint	1. Budget limitations faced by the Regional Government
Goals	1. Building wastewater management on city, regional, and communal scales
	2. Optimising water resources management that considers environmental sustainability
	3. Increasing the role of the community in managing water resources
Indicator	1. Availability of human resources who have knowledge, understanding, and enthusiasm for preserving the environment
Programs/activities	1. Establishing a structured communication pattern and training for the Forum DAS in river management
Institution	1. Regional Government/Jember Regency Government
	2. Universities

RPJMD 2021-2026; the main influencing factor was found in SDGs Goal 6 (Clean Water and Decent Sanitation). The results of the link between EQI and the implementation of SDGs in Jember Regency show that there are high levels of environmental development issues in SDG 6 that have not been achieved; the Water Quality Index (WQI) is in the medium category, which greatly influences the value of the Jember Regency Environmental Quality Index (EQI).

It was also found that the frequency of SDG 11 development issues, which had not been achieved was low enough for the Air Quality Index (AQI) to be in the good category and that the frequency of SDGs 15 development issues which had not been achieved was high enough for the Land Cover Quality Index to be in the medium category, but the Provincial Government implements the Land Cover Quality Index (LCQI) policy. The program recommendations were based on analysis using the Interpretative Structural Modelling (ISM) method, in which six elements were studied with key sub-elements, forming a structured communication pattern and training. The Watershed Forum or Forum DAS in river management is the main program that can be implemented with indicators. The main issue is the availability of human resources, who have knowledge, understanding, and enthusiasm for preserving the environment, with the main aim of increasing the role of society in managing water resources so that the goal of optimising water resources management that considers environmental sustainability can be achieved. This would increase the value of EQI in implementing SDGs in the Jember Regency.

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Conflict of Interest Statement

The authors declare that they have no conflict of interest.

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