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Research Article

Optimising the Role of Bappeda in Improving the Regional Economy Based on Local Natural Resources (SDA)

A Soft Systems Methodology (SSM) Approach

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Abstract. Regional natural resource management (SDA) faces complex problems (wicked problems) such as conflicts of interest, overlapping regulations, and gaps between planning and implementation documents. This study analyses the optimisation of the role of the Regional Development Planning Agency (Bappeda) as a coordinator and facilitator of natural resources-based economic development, not as a technical regulatory body, but as an ecosystem enabler within the framework of the Regional Innovation System (SIDa) and the principles of the SIDa Radar.Using Soft Systems Methodology (SSM), this study utilises a rich picture, CATWOE analysis, a conceptual model, and comparison with empirical conditions through interviews and observations. The results of the study show that the main problem is not only the absence of technical instruments, but the difference in worldview between the orientation of short-term growth and the need for sustainable development. The optimisation of Bappeda needs to be directed at strengthening coordination across Regional Apparatus Organisations (OPD) through the Thematic Musrenbang, which is equipped with a safety mechanism for elite capture, a SIDa-based cross-actor task force, and socio-ecological evaluation indicators that still respect the technical authority of DLH/KLHK. This research expands the application of SSM in public administration and offers a strategic roadmap for local governments to manage natural resources in an inclusive, adaptive, and sustainable manner.

Keywords: Bappeda; Governance; Natural Resources; Regional Economy; Soft Systems Methodology.

1. Introduction

Natural resources (SDA) are widely regarded as one of the main pillars for encouraging regional economic independence and growth. The abundant availability of natural resources should serve as a production base, create jobs, and improve the welfare of local communities. However, in practice, natural resource management often faces a classic paradox: the abundance of resources is not always directly proportional to improvements in welfare. This phenomenon in the development literature is known as the resource curse, a condition in which the exploitation of natural resources triggers inequality in the distribution of benefits, economic marginalisation of local communities, and environmental degradation (Lacárcel et al., 2023). Weak policy integration is often exacerbated by suboptimal implementation, in which existing regulations fail to reconcile economic interests with the protection of fragile ecosystems (Kembauw et al., 2024).

In the regional context, these problems are not only related to the presence of natural resources but are also influenced by the quality of governance, power relations among actors, and the direction of the ongoing economic transformation. Thus, the problem of natural resource management at the local level reflects the challenge of achieving inclusive development amid the pressures of industrialisation and changes in the economic structure.

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On the other hand, the paradigm shift from conventional development administration to sustainable policy innovation requires local governments to increase institutional capacity and adopt a participatory approach to planning (Handini et al., 2025). This transformation is crucial, as the effectiveness of regional development policies requires synchronisation among regulations, institutions, and actors to harmonise the interests of various parties. The integration of community participation in natural resource governance has been shown to increase the economic impact of the village while maintaining environmental sustainability (Hayat & Makhmudah, 2016). Accessibility gaps and low-quality human resources are often the main obstacles to converting the potential of local commodities into competitive added value for community welfare (Paramita et al., 2018).

In the Indonesian context, this shift can be emphasised through the Regional Innovation System (SIDa) framework, as mandated by Law No. 11 of 2019 concerning the National System of Science and Technology. SIDa provides an institutional foundation for connecting local governments, technical regional apparatus, business actors, academics, and communities within an innovation ecosystem oriented towards local problem-solving. Thus, the idea of Bappeda as an ecosystem enabler is not an ad hoc construct but a strengthening of Bappeda's coordinating function in integrating development planning, regional innovation, and the sustainable use of natural resources. Measurement models, such as the SIDa Radar, can serve as an initial reference for assessing institutional readiness, collaboration capacity, innovation networks, and program sustainability (Maninggar et al., 2023).

Tangerang Regency represents this dynamic in real terms. As a buffer area of the capital city with a high level of industrialization, Tangerang Regency is experiencing rapid economic transformation. On the one hand, this region has strategic natural resource potential, especially in the coastal fisheries sector in the northern region and the agricultural sector in the southern region. In contrast, industrial expansion, land conversion, and environmental pressures such as coastal abrasion have significantly changed the structure of the local economy. The gap in the implementation of this development policy is exacerbated by weak social cohesion and limited dialogue space that brings together the needs of citizens with the direction of regional strategic development (Adiningrum et al., 2025). This condition is compounded by the fragmentation of roles between agencies and the lack of stakeholder involvement in integrated planning, which results in a misalignment between regional policies and the aspirations of the community on the ground (Tranggono, 2021).

However, the weakness of the dialogue space cannot be understood solely as a technical issue of participation. In regional planning practice, forums such as Musrenbang have the potential to shift into administrative rituals if community proposals do not have a clear path to the RKPD, or if the community does not provide clear information. Therefore, strengthening the role of Bappeda needs to be accompanied by a mechanism to maintain the substance of deliberation, transparency in tracking proposals, and measurable priority criteria so that participation does not stop at formal attendance, but effectively influences development decisions.

This transformation gives rise to economic dualism, where the modern industrial sector grows dominantly in its contribution to the Gross Regional Domestic Product (GDP), while traditional sectors such as agriculture and fisheries tend to be stagnant, both in terms of economic contribution and labor absorption (Bashir et al., 2019). This condition shows that the economic growth that has occurred is not fully inclusive, especially for people who are directly dependent on natural resources (Syawie, 2011). In addition, rural-urban inequality is increasingly exacerbated by the conversion of agricultural land into uncontrolled built-up areas (Septiawan & Mardiah, 2025). In fact, the optimization of strategic agricultural sectors based on regional superior products could serve as an instrument to improve community welfare (Firdaus et al., 2025).

Furthermore, this dynamic reflects the characteristics of wicked problems, which are complex, multidimensional, and cannot be solved through a linear policy approach. Conflicts of interest between local governments that encourage investment, industry players in need of land expansion, and local communities that depend on access to natural resources create ongoing tensions. Differences in perspectives between stakeholders further complicate the formulation of fair and sustainable policies. Solving this problem requires the implementation of collaborative governance that is able to mediate conflicting interests through inclusive dialogue to mitigate the risk of land access inequality (Almanso, 2025). The implementation of this collaboration model requires a cross-sectoral commitment to overcome policy and KPI fragmentation in each field that has been hindering the effectiveness of resource management at the regional level (Sendika & Magriasti, 2026).

It is at this point that SIDa becomes relevant as a bridge between collaborative governance and policy instruments that have been known in regional innovation governance. SIDa allows Bappeda to orchestrate actors without taking over the technical authority of sectoral OPDs. Within this framework, Bappeda plays a role in aligning agendas, facilitating cross-actor learning, integrating data, and ensuring that natural resource-based economic programs are linked to product innovation, local value chains, ecosystem protection, and community capacity building.

These conditions necessitate an analytical approach that is not only technocratic, but also able to capture the social complexity and dynamics of interaction between actors in natural resource management.

To date, the optimization of the role of the Regional Development Planning Agency (Bappeda) in natural resource management tends to be dominated by a hard systems approach, which is oriented towards linear, technocratic, and procedural solutions. This approach is realized through instruments such as the preparation of budget allocations as needed and formal planning documents, and the issuance of new regulations. However, this approach often fails to address the complexity of the problem at the implementation stage. In contrast, policy fragmentation on the ground often triggers agrarian conflicts and inequality in land allocation, which ultimately hinders the sustainability of traditional economic sectors (Thetanaya & Thetanaya, 2021). This condition confirms that the dominant formal procedures tend to ignore the political dimension and rationality of the actors, thereby obscuring public preferences in the decision-making process (Mukhlis et al., 2018). Therefore, a deep understanding of the motivations, capacities, and beliefs of actors is needed to align diverse interests in a collective deliberation (Noor et al., 2023). In this context, collaborative governance offers a strategic alternative by facilitating equal interaction between actors to formulate common goals that are able to accommodate real needs at the site level (Iskandar, 2021).

In practice, regional development planning is inseparable from social dynamics, local politics, and interaction between actors. The overlap of programs between Regional Apparatus Organizations (OPDs), differences in interests, and diverse worldviews between stakeholders are factors that are not fully accommodated in the technocratic approach. As a result, various development programs, especially in the fisheries and agriculture sectors, often experience gaps between planning and implementation. This failure often stems from a closed and dominant policy-making process, which fails to identify and accommodate the aspirations of the local community as a whole (Mulyadi, 2018). In addition, the dominance of formal mechanisms in development planning deliberations often overshadows informal aspiration channels that better reflect the real needs of communities at the site level (Wicaksono, 2012). Therefore, the institutionalization of a participatory paradigm that is formally integrated into village governance is crucial to ensure that spatial plans are truly aligned with local development priorities (Supriyanto & Dominika, 2025).

As an illustration, fishermen's empowerment programs can fail not only due to budget limitations, but also due to the clash between the short-term economic growth orientation of local governments and the needs of sustainable development. Therefore, strengthening collaboration between actor's government, the private sector, and the community—is the main determinant in realizing a more realistic and community-oriented development policy (Nurmarini, 2018).

Based on this description, the formulation of this research problem is: how to formulate a strategy to optimize the role of the Tangerang Regency Bappeda in improving the regional natural resource-based economy by accommodating social and economic complexity, differences in perspectives between stakeholders, and the limits of institutional authority through the Soft Systems Methodology (SSM) approach. This formulation places Bappeda as a coordinator, facilitator, and integrator of planning, not as an institution that provides environmental technical approvals. Technical functions such as environmental approval, environmental feasibility tests, and technical supervision remain under the authority of DLH/KLHK in accordance with the applicable regulatory framework, while Bappeda plays a role in ensuring that the results of these technical studies are included in the priorities of planning, budgeting, and evaluating regional development (Akhirun & Zees, 2025), (Fadli & Nurlukman, 2018).

This research aims to go beyond conventional descriptive approaches through the application of a holistic systemic analysis framework. Specifically, the objectives of this study are: Mapping unstructured problem situations in natural resource management in Tangerang Regency through rich picture visualization; Formulating root definitions using CATWOE

analysis to accommodate various perspectives (worldviews) related to the role of Bappeda; Developing a conceptual model and identify feasible and desirable changes in order to optimize the role of Bappeda.

The novelty of this research lies in the integration of Soft Systems Methodology (SSM), Local Economic Development (LED), and Regional Innovation System (SIDa) to formulate the role of Bappeda as an ecosystem enabler in the management of native regional natural resources. Different from regional governance studies which are generally descriptive and emphasize coordination between agencies in a normative manner, this study offers a systemic model that maps actors, worldviews, conflicts of interest, limits of authority, and feasible and desirable change options. Thus, the contribution of this research is not only in explaining the problem, but also in the preparation of conceptual models and action plans that can be used by Bappeda to connect the planning process, regional innovation, budgeting, and socio-ecological sustainability.

This research addresses the gap regarding the limited use of SSM to build a multi-perspective model of the role of Bappeda in the context of the wicked problem of natural resource management. In addition, this research strengthens the idea of ecosystem enabler by linking it to existing policy instruments, namely SIDa/Radar SIDa, while recognizing political risks such as elite capture, ceremonial Musrenbang, and legislative-executive budget discretion. Recognition of these factors makes the proposed model more realistic than the technocratic approach that relies solely on the establishment of new forums or regulations.

Research on the role of Bappeda and natural resource management in general is still dominated by normative-administrative and quantitative approaches that assume that the system is linear and measurable. This approach has not been able to explain the complexity of actor relationships, conflicts of interest, and differences in perspectives that are the main characteristics of problems at the local level.

In addition, although the approach of Local Economic Development (LED) and collaborative governance have been widely discussed, most of this work is still conceptual and has not been supported by an operational analysis framework capable of capturing the dynamics of wicked problems. On the other hand, the study of natural resource management tends to be fragmented between economic, environmental, and institutional perspectives, without comprehensive integration.(Alexander et al., 2022; Qasthary et al., 2025)

Furthermore, the use of Soft Systems Methodology (SSM) in the context of regional development planning in Indonesia, especially in analyzing the role of Bappeda, is still very limited. In fact, SSM offers an approach that accommodates complexity, subjectivity, and conflict of perspective in human activity systems. The application of the Soft Systems Methodology in this study fills this gap by transforming a messy problem situation into a structured systemic framework, allowing for an in-depth understanding of empirical realities that are often overlooked by conventional methods (Octasylva, 2021), (Suryawati et al., 2023). By utilizing CATWOE analysis, this study simplified the complexity of inter-stakeholder interactions into relevant key elements, thus providing a foundation for more adaptive policy transformation (Hannaingtyas, 2021).

Based on these conditions, this study fills the gap by integrating the SSM approach in the analysis of Bappeda's role as a facilitator of natural resources-based economic development. This approach is expected to produce a strategy that is not only technically feasible, but also adaptive to social dynamics, and relevant in dealing with the characteristics of wicked problems at the regional level. Thus, the use of this method is not just an occasional technical tool, but a strategic perspective in managing a complex human activity system full of conflicts of interest (Aldianto et al., 2020.

2. Literature Review

Bappeda's Strategic Role in Local Economic Development (LED)

The Regional Development Planning Agency (Bappeda) has a major role in regional development planning, which includes the preparation of planning documents such as the Regional Medium-Term Development Plan (RPJMD) and the Regional Government Work Plan (RKPD) (Hatisqa, 2015).

Local Economic Development (LED) is an effort to optimize local resources involving various stakeholders to develop the regional economy (Haryati, 2018). This optimization requires the adoption of open government principles that emphasize transparency, participation, and collaboration to ensure that development programs reflect the needs of the community (Premilasari et al., 2023). In addition, the weak coordination between institutions

often results in development policies that do not reflect the real needs and aspirations of the community on the ground (Sulastusi & Deviani, 2018).

In this study, LED is not understood separately from SIDa. LED provides an orientation to the creation of added value in the local economy, while SIDa provides an institutional framework to coordinate innovation across actors. The combination of LED-SIDa places Bappeda as a coordination node that brings together sectoral data, local commodity innovations, business networks, academics, community members, and regional development regulations. Using the Radar SIDa principle, regional capacity can be evaluated through institutional dimensions, actor networks, human resource capacity, policy support, and program sustainability, so that the ecosystem enabler function has a more operational conceptual basis and indicators.

Dynamics of Natural Resources Management as a Wicked Problem

Natural resource management in areas with high development pressure can be understood as wicked problems. This concept, introduced by Rittel and Webber (1973), describes a complex problem, difficult to define singularly, and lacks a final solution (Forester, 2019).

In the context of Tangerang Regency, wicked problems are manifested in the tension between the expansions of industrial estates. Conventional hard systems-based approaches, which assume that development problems can be formulated objectively and resolved through technical instruments such as regulation, top-down planning, and budget allocation, are often ineffective when faced with the complexity of natural resource governance involving conflicts of interest, diversity of actors, and local socio-political dynamics; however, in the context of the post-Job Creation Law that tends to centralize approval, the shift towards a soft systems approach is not intended to challenge such formal authority, but rather to complement it through strengthening coordination, joint learning, and integration of stakeholder perspectives in the regional planning process.(Checkland, 1989). As a result, inter-agency coordination is often hampered by overlapping authority triggered by a fragmented vision of development, making it difficult for interaction between the government and the community to reach a common ground in efforts to optimize resource utility (Hidayat & Safitri, 2019; Sadono, 2018). This condition necessitates policy integration that not only relies on spatial planning, but also on adaptive institutional coordination to mitigate conflicts of interest at various levels (Junita & Buchori, 2016; Kurniadi et al., 2023).

Soft Systems Methodology (SSM)

To overcome the limitations of the hard systems approach, Checkland developed the Soft Systems Methodology (SSM)(Checkland, 1989) as an analytical framework for understanding and managing complex and unstructured problem situations. SSM does not aim to produce a single optimal solution, but rather to facilitate a systemic learning process to identify feasible and desired changes. This approach operates by viewing the problem as part of an interconnected system, thus emphasizing the importance of interdependence between components rather than the isolation of a single element (Machado et al., 2023).

SSM is based on the assumption that social reality is subjective and constructed by various actors with different perspectives. Therefore, this approach emphasizes the importance of exploring multiple viewpoints before formulating policy interventions. The two main instruments in SSM used in this study are as follows:

Rich Picture, which is a visual representation that describes the problem situation holistically, includes the actors, relationships, processes, and conflicts that occur. This tool allows researchers to capture complexities that are often not documented in formal documents. In this context, the rich picture is used to map the tension between the economic development agenda and the social reality of coastal and agricultural communities. * Conceptual Models, which are representations of human activity systems that are arranged based on the worldview of actors, and function to define the desired changes to improve the problematic situation (Nattassha et al., 2020).

Root Definition and CATWOE analysis, which are used to comprehensively formulate a human activity system. CATWOE consists of: Customers (beneficiaries or affected parties), Actors (executors of activities), and Transformation (change processes), Worldview (the framework of meaning that underlies the system), Owners (parties with authority), and Environmental Constraints (external constraints). This analysis helps ensure that the formulation of the system is not biased against one particular perspective. By applying this analysis, the complexity of the problem can be broken down into key elements that are

interrelated, thus enabling the formulation of more inclusive strategic solutions for all parties involved in the system (Septiana & Maulany, 2021).

Research Framework of Thought

This research framework was built from the need to bridge the gap between empirical complexity and institutional response. In the context of Tangerang Regency, the problem of natural resource management is not only in the form of sectoral program issues, but also related to silos between OPDs, industrialization conflicts with coastal-agrarian sustainability, as well as differences in worldviews between technocratic, political, industrial, and local community actors. Therefore, SSM is used as a systemic learning approach to transform unstructured problem situations into models of human activities that can be compared to real conditions and translated into feasible and culturally desirable actions.Drawing on a literature review, this study is based on the premise that optimizing the role of Bappeda in natural resource management requires a shift from a technocratic approach to a systemic approach that accommodates social complexity.

The framework of this research is arranged in stages as follows: (1) identify unstructured problem situations in the management of natural resources in Tangerang Regency; (2) map the dynamics and relationships between actors through the rich picture where this is part of the problem of detail explained in the form of images; (3) formulate the ideal system perspective through root definition with the CATWOE approach; (4) develop a conceptual model; and (5) compare the model with empirical conditions to produce recommendations for changes that are feasible (technically feasible) and desirable (socially and ethically acceptable). Through this framework, it is hoped that a strategy for optimizing the role of Bappeda can be formulated that is more contextual, inclusive, and sustainable. The SSM process can be seen in Figure 1.

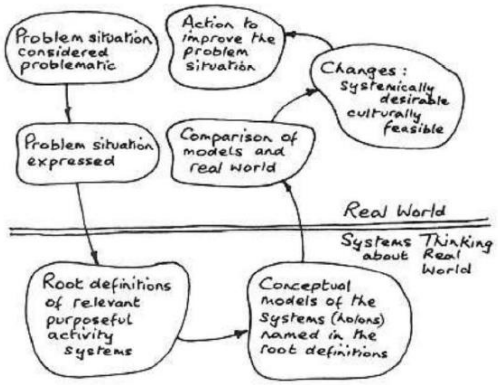


Figure 1. SSM Process (Source: Septiana, 2021).

3. Proposed Method

This research uses a qualitative approach with a case study design. The qualitative approach was chosen because the phenomenon studied, the optimization of the role of Bappeda in natural resource management, is complex, dynamic, and fraught with the construction of meaning from various stakeholders. The case study design allows researchers to conduct an in-depth exploration of the specific context of Tangerang Regency as a complete case unit.

Specifically, this study applies the Soft Systems Methodology (SSM) framework developed by Peter Checkland through the tradition of systems thinking and systems practice. SSM is used not as a tool to "solve" problems in isolation, but as a structured learning method to understand problematic situations, map different worldviews, compile root definitions, build conceptual models, and formulate changes that are systemically desirable and culturally feasible (Checkland, 1981; Checkland & Scholes, 1990).

This research focuses on in Tangerang Regency, Banten Province, as one of the areas that experienced industrialization pressure while having a significant base of coastal and agricultural natural resources. Field data collection is planned to take place from May to June 2026.

The study uses a purposive sampling technique, which is the deliberate selection of informants based on certain criteria that are relevant to the purpose of the research. To ensure the depth and credibility of the data, this study uses the following triangulation of data collection methods.

Data Analysis Techniques: Seven-Stage Adaptation of SSM

The data analysis in this study follows the iterative flow of seven stages of SSM. The stages are executed flexibly, but still refer to the following logical sequence. To reduce technocratic bias and bureaucratic resistance, the model-to-reality (Stage 5) and action formulation (Stages 6-7) stages are carried out through limited validation to technical informants and key stakeholders. This validation is directed at assessing whether the proposed changes are only systemically ideal or also institutionally, politically and budgetarily, and organizational culture feasible. Thus, member checking not only examines the accuracy of the narrative, but also tests the feasibility of implementing the model in regional bureaucracies that have hierarchy, sectoral interests, and risks to officials' career security.

Stages 1 & 2: Unstructured Problem Situations and Situation Presentation (Rich Picture)

Preliminary data from interviews, observations, and documents were analyzed to identify actors, issues, conflicts, and power relations in natural resource management. This information is then incorporated into the rich picture as a visual representation of the problem situation. The rich picture is discussed and, where possible, validated on a limited basis to a few key informants to ensure that the dynamics depicted reflect reality and are not dominated by the researcher's point of view.

Stage 3: Formulation of Root Definitions

Based on the rich picture, the researcher compiled several root definitions that represent relevant human activity systems, especially related to the role of Bappeda in natural resource management. Each root definition is analyzed using the CATWOE (Customers, Actors, Transformation, Weltanschauung, Owners, and Environmental constraints) framework to ensure that it is comprehensive and accommodates a wide range of perspectives.

Stage 4: Conceptual Models

For each root definition that is considered representative, a conceptual model is prepared in the form of a series of interrelated activities (generally 5–9 main activities). This model illustrates how the ideal system should work to achieve the expected transformation, for example, the transformation from sectoral-technocratic planning to collaborative-inclusive planning based on natural resources.

Stage 5: Comparison of the Model with Real Situations

The researcher compared the model with the real situation using three criteria: (1) systemic suitability, namely the extent to which the ideal activity answers the problems of coordination, economic added value, and ecological sustainability; (2) institutional feasibility, namely the extent to which the activity is in accordance with the authority of Bappeda, technical OPD, DLH/KLHK, as well as regional planning-budgeting mechanisms; and (3) socio-political feasibility, that is, the extent to which the proposed actions are able to reduce the risk of ceremonial Musrenbang, elite capture, and top-down priority dominance. The principles of SIDa Radar are used as a conceptual reference to read institutional readiness, actor networks, innovation capacity, and program sustainability.

The conceptual model is then systematically compared with the real situation that has been mapped in Stages 1 and 2. This comparison aims to identify gaps; that is, activities that appear in the ideal model but are not implemented or do not function in the field, as well as activities that run but do not support the desired transformation. This analysis also reveals the factors that cause the gap, such as regulatory barriers, differences in KPIs in each field or limited institutional capacity.

Stage 6: Identification of Feasible and Desirable Changes

Based on the gaps found, the researcher formulated alternative changes that meet two main criteria of SSM: (1) systemically desirable, which is in line with the logic of the constructed human activity system; and (2) culturally feasible, i.e., the thematic Musrenbang is designed to be realistic in the context of bureaucratic, institutional, and political dynamics of Tangerang Regency by utilizing cross-SKPD coordination, formal documentation, and a feedback loop, so that the aspirations of the community remain integrated into the RKPD despite facing top-down resistance or legislative discretion

Stage 7: Formulation of Action Recommendations

In the context of academic research, the action stage is articulated as a strategic recommendation for the Tangerang Regency Bappeda. Recommendations are prepared in the form of proposals to strengthen roles, coordination mechanisms, and the design of actionable

policy interventions, and are formulated by referring back to the key concepts and frameworks of LEDs, wicked problems, and SSM.

4. Results and Discussion

This section is the core of the research, where empirical data from Tangerang Regency is systematically analyzed using the Soft Systems Methodology (SSM) framework. The analysis moves from mapping complex problem situations, to the formulation of concrete and actionable changes by Bappeda acting as an ecosystem enabler within the framework of Local Economic Development (LED) by facilitating collaboration between development actors, which is in line with the Regional Innovation System (SIDa) approach as regulated in Law No. 11/2019, so that this research links the transformation of the role of Bappeda with the regional innovation policy framework to strengthen theoretical and practical foundations.

Unstructured Problem Situations and Rich Picture (Level 1 & 2 SSM)

Based on the results of interviews and participant observation, natural resource management in Tangerang Regency cannot be reduced to an ordinary technical problem but is rather an unstructured problem situation. This situation is characterized by overlapping authority, differences in KPIs in each field, investment pressures, and the vulnerability of coastal communities and farmers to spatial changes and environmental degradation. Various subjective views from stakeholders regarding development priorities show the complexity of the situation that demands an in-depth understanding through the exploration of various related perspectives (Ritonga, 2023). As a visual representation of this complexity, the rich picture prepared illustrates the tense relationship between the demands of economic growth and the need for ecosystem protection that is currently not optimally integrated (Arumsari et al., 2022). This visualization confirms the dissonance between extractive policy orientation and the urgency of community-based resource conservation, which indicates the need to redefine the role of stakeholders in the current governance structure (Paduloh et al., 2020). In addition, the identification of these systemic dynamics facilitates an understanding of inter-sector dependencies that often trigger undesirable consequences in the management of coastal and agricultural areas (Khairulbahri, 2022).

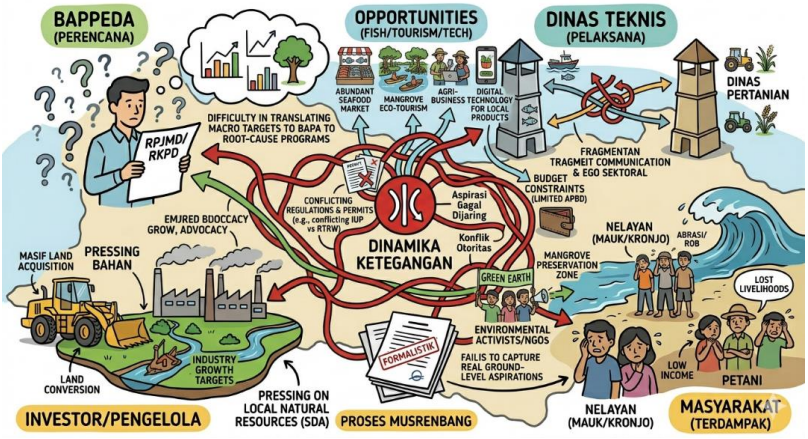


Figure 2. Rich Picture of Natural Resources Management in Tangerang Regency.

To visualize this complexity, this study compiled a rich picture (Figure 2 and Figure 3) that maps the main actors, streams of interest, conflicts, and limits of authority in the management of natural resources in Tangerang Regency. This rich picture is not intended as a single final representation, but as a joint learning tool to open up differences in worldviews between Bappeda, technical OPDs, industry players, local communities, political-budget actors, and the central government. (Defrizal et al., 2022; Sydelko et al., 2020) The limitation of the rich picture lies in the possible differences in interpretation between actors; therefore, this visualization should be read as an starting point for discussion, not as a single objective claim to social reality.

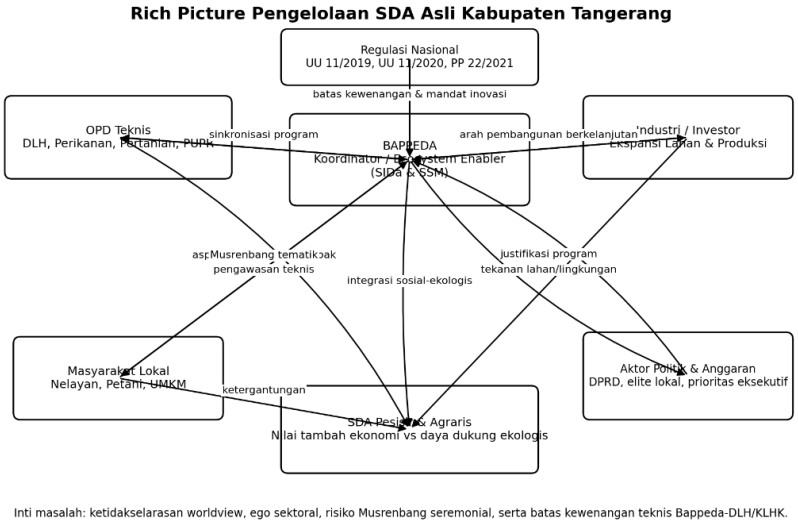


Figure 3. Rich Picture of Natural Resources Management in Tangerang Regency.

Root Definition and CATWOE Analysis (SSM Stage 3)

Based on the mapping of the situation in the rich picture, this study formulates a root definition that unites various fragmented perspectives into one coherent human activity system: "A system facilitated by the Tangerang Regency Bappeda to transform the potential of raw natural resources that are not managed and threatened with marginalization into an inclusive, innovative, and sustainable local economic ecosystem through cross-OPD coordination, sectoral data integration, strengthening the added value of local commodities, and SIDa-based deliberative forums, while respecting the limits of DLH/KLHK's technical authority in environmental approval and supervision."

This definition reflects three main theoretical pillars: the strategic role of Bappeda in LED, the character of wicked problems in natural resource management, and SSM's view of human activity systems. To operationalize the root definition, CATWOE analysis is used to identify crucial systemic elements, where Customers include affected communities and local economic actors, while Actors involve various OPDs and related stakeholders (Karay et al., 2020), (Kurniawan & Maulana, 2022).

To ensure that the definition is comprehensive and not biased toward a single perspective, a CATWOE analysis is carried out as shown in Table 1. To visualize this complexity, this study compiled a rich picture (Figure 2 and Figure 3) that maps the main actors, streams of interest, conflicts, and limits of authority in the management of natural resources in Tangerang Regency. This rich picture is not intended as a single final representation, but as a joint learning tool to open up differences in worldviews between Bappeda, technical OPDs, industry players, local communities, political-budget actors, and the central government. (Defrizal et al., 2022; Sydelko et al., 2020) The limitation of the rich picture lies in the possible differences in interpretation between actors; therefore, this visualization should be read as an starting point for discussion, not as a single objective claim to social reality.

Table 1. CATWOE Analysis of the Role Optimization System of Bappeda in Natural Resources Management.

CATWOE Elements	Description
C (Customers)	Local communities are economic beneficiaries (traditional fishermen, farmers, MSMEs processing natural resources).
A (Actors)	Bappeda (facilitators/coordinators), related technical OPDs (DLH, fisheries, agriculture, PUPR), sub-district/village governments, BUMD/MSMEs, industry players, academics, community groups, and DPRD/political-budget actors as parties that can support or hinder program integration.
T (Transformation)	Transforming inputs in the form of unmanaged raw natural resource potential and vulnerable community groups, through participatory planning processes and program synchronization, into outputs in the form of a more inclusive and sustainable regional economic ecosystem.

W (Worldview)	"Regional development must prosper local communities without damaging the carrying capacity of the environment"; Economic growth must not come at the expense of ecology and social justice.
O (Owners)	The regents and regional leaders as the owners of the policy mandate, Bappeda as the planning coordinator, and the DPRD as the actor who influences the legitimacy and allocation of the budget. The technical authority for the environment remains with DLH/KLHK according to regulations.
E (Environment)	National and regional regulations, Law No. 11/2019 concerning Science and Technology Systems/SIDa, Law No. 11/2020 and Government Regulation No. 22/2021 related to the environment, regional fiscal limitations, risks of ceremonial Musrenbang, budgetary discretion, as well as pressure on industrialization and land conversion.

Conceptual Model of Human Activity Systems (Stage 4 SSM)

Departing from the root definition and CATWOE, a conceptual model was developed that describes how the ideal system should work to achieve the transformation from sectoral-technocratic planning to collaborative-inclusive planning based on natural resources. This conceptual model consists of several main interrelated activities, including:

To align with SIDa, the conceptual model is not designed to form a new stand-alone structure, but rather to strengthen existing coordination nodes through collaboration mechanisms, innovation indicators, and implementation tracking. Thus, Bappeda acts as an orchestrator of the regional innovation ecosystem: connecting technical OPDs, academics, the business world, communities, and political-budgetary actors, while ensuring that environmental technical recommendations from DLH/KLHK enter the planning and budgeting cycle.

a. Map the potential and vulnerability of natural resources in a participatory manner with the community, technical OPDs, and academics.
b. Facilitate regular and structured cross-OPD coordination forums to harmonize development programs that touch the natural resources sector.
c. Integrate and validate the analysis of carrying capacity and environmental capacity into the planning document (RPJMD/RKPD) through coordination mechanisms and recommendations between SKPDs prior to agreement, so that the role of Bappeda focuses on aligning sustainable development planning without going beyond the technical authority that is the domain of DLH/KLHK in accordance with the NSPK.
d. Advocate for affirmative budget allocation for local natural resource empowerment, strengthening the coastal/agricultural economy, and climate change adaptation.
e. Monitor and evaluate the implementation of programs based on sustainability indicators (economic, social, environmental), not only based on budget absorption and physical output.

This model is not a representation of "what is happening", but rather an elaboration of a human activity system that is "systemically desirable" according to the principles of SSM, LED, and sustainable natural resource management.

The cultural feasibility of this model should be carefully assessed. It is not enough to make changes through the establishment of new forums, because regional bureaucracies often work within the logic of hierarchy, career prudence, and political-budgetary priorities. Therefore, each recommendation in the conceptual model must be equipped with a mechanism for proposal transparency, a firm division of roles, success indicators, and the support of regional heads so that they do not remain merely a normative agenda.

Comparison of Models with Reality and Formulation of Change (Stages 5 & 6 of SSM)

The critical stage in SSM is to compare the conceptual model (Stage 4) with the reality on the ground (Stages 1 and 2) to identify gaps and formulate changes that are systemically desirable as well as culturally feasible(Checkland, 1985). The results of the comparison are summarized in Table 2.

Table 2. Gap Analysis and Change Formulation.

Ideal Activities in Conceptual Models	Reality in Tangerang Regency Today	Formulation of ***Feasible & Desirable*** Changes
Bappeda integrates the results of environmental technical studies and carrying capacity data into the planning process,	Conceptually, Bappeda is expected to coordinate the direction of development, but the technical authority	Structural changes: the preparation of a memorandum of coordination mechanism for natural resource planning across OPDs that contains the obligation to include DLH/KLHK technical recommendations

without taking over the authority of DLH/KLHK technical approval.	for the environment lies with DLH/KLHK.	into the RKPD, without creating new permits or additional technical approvals.
Facilitate seamless and substantive cross-OPD coordination.	The silo mentality remains strong; sectoral programs run independently, Musrenbang tends to be an administrative forum for submitting proposals, rather than a space for strategic deliberation.	Procedural changes: the transformation of Musrenbang into a Regional-Based Thematic Musrenbang equipped with proposal tracking, publication of decisions, priority criteria, and budget oversight so that it does not become a ceremonial forum.
Monitor and evaluate based on sustainability indicators.	Program evaluation places greater emphasis on physical achievements and budget absorption; The impact on community welfare and environmental quality has not been systematically measured.	Capacity change: the shift in the role of Bappeda from document administrators to facilitators of the SIDa ecosystem through data strengthening, cross-actor learning forums, monitoring dashboards, and socio-ecological indicators.

This gap analysis clearly shows how the factors discussed as wicked problems such as overlapping programs, limited authority, and conflicts of policy orientation manifested in natural resource management practices. Realistic changes from the existing institutional system must remain in accordance with the legal authority of Bappeda. Roles that can be strengthened include coordination, cross-sector facilitation, and integration of technical recommendations, without taking over the authority of technical sustainability clearances that are in the TUKLH, DLH, or KLHK. The implementation of these measures demands a strong leadership commitment to navigate bureaucratic cultural barriers, so that planned changes are acceptable to stakeholders and become an integral part of the regional governance tradition (Suyeno et al., 2024). In line with these steps, human resource capacity development through routine training and the use of information technology for integrated data management is the main key in supporting evidence-based decision-making (Afdhal et al., 2022). In addition, institutional strengthening through participatory dialogue needs to be intensified to overcome the obstacles of coordination between agencies and the clarity of regulations. In order for the Thematic Musrenbang forum not to become a ceremonial ritual, this mechanism includes transparent procedures, documentation of community proposals, formal follow-up, and cross-regional supervision, so that the aspirations of the community are truly integrated into the RKPD despite political-economic obstacles such as legislative dominance or top-down executive priorities.(Sudipa et al., 2020; Supardiono et al., 2021). In this context, the adoption of inclusive decision support tools can increase trust and legitimacy of policy results in the eyes of the public, while answering the challenge of limited data in local ecosystem management (Yuniarti et al., 2023).

As a follow-up to Stage 6, Stage 7 of SSM in the context of this research is translated into a matrix of strategic action plans that are concrete, measurable, have clear responsible persons, and are time-oriented. The matrix summarizes a number of actions, including: Bappeda aligning sustainable natural resource development planning with RPJMD, RKPD, sectoral priorities, and community aspirations without exceeding its authority, the establishment of a triple helix-based Natural Resources Economic Acceleration Task Force, the development of a digital dashboard for natural resource monitoring, and the facilitation of targeted CSR partnerships between large industries and local business actors. This implementation process will later function as a continuous learning cycle, where every real action will be evaluated to provide feedback for iterative system improvement (Suryawati et al., 2024). Thus, this approach ensures that sustainability is not seen as a static target, but rather as a dynamic process that adapts through measurable experimentation and collective organizational learning (Wamsler et al., 2014). This final stage confirms that the desired changes require full acceptance from interested parties so that the software system methodology cycle can be considered complete and have a real impact on governance (Hutabarat et al., 2020). The active involvement of actors in this stage not only ensures the sustainability of changes in procedures and structures, but also changes organizational

attitudes in responding to environmental challenges in an adaptive (Sinulingga & Hartomo, 2021).

This matrix also realigns the results of SSM implementation with the LED framework and the strategic role of Bappeda that has been discussed in Chapter II: from just compiling documents, to facilitating a collaborative ecosystem oriented towards sustainability and social justice.

Stage 7 of the SSM translates into a concrete, measurable, clear and time-bound Strategic Action Plan. The following is a matrix of action recommendations to optimize the role of the Tangerang Regency Bappeda:

Table 3. Strategic Action Plan Matrix for Optimizing the Role of Bappeda (Stage 7 SSM).

No.	Strategic Action (What)
1	Preparation of a SIDa-based Sustainable Natural Resources Planning Synchronization Memorandum mechanism, which integrates DLH/KLHK technical recommendations into the RKPD without forming new permits/clearances.
2	Thematic Musrenbang Pilot Project in 2 representative areas (e.g., Mauk for coastal and Sukadiri/Sepatan for agrarian) with anti-tokenism mechanism and proposal tracking.
3	Strengthening the SIDa/Triple Helix Based Natural Resources Innovation Ecosystem Forum/Task Force as a coordination space for Bappeda, technical OPDs, academics, business actors, communities, and political-budget actors.
4	The development of an integrated Natural Resources Monitoring Digital Dashboard to monitor land conversion, commodity value-added programs, Musrenbang proposed status, and socio-ecological indicators.
5	Facilitation of Targeted CSR Partnership between Large Industries in Tangerang Regency and MSMEs.

5. Conclusions

The management of indigenous natural resources (SDA) in Tangerang Regency has proven to be not just a technical problem that can be solved with a linear approach, but a wicked problem characterized by competing interests, as well as the gap between macro planning documents (RPJMD/RKPD) and socio-ecological realities on the ground.

The application of the Soft Systems Methodology (SSM) shows that the hard systems approach—based on budget additions, rigid regulations, and top-down planning—is no longer adequate to optimize the role of Bappeda in the context of SDA-based LEDs. The rich picture and CATWOE analysis revealed that the core of the problem lies in the misalignment of perceptions between the economic growth orientation carried by the owners and the needs of ecological sustainability and social justice that customers are fighting for.

The comparison of the conceptual model with real conditions confirms that optimizing the role of Bappeda requires the transformation of the institutional role from "administrator of planning documents" to "facilitator of the collaborative ecosystem". This transformation requires three dimensions of change that are at once systemically desirable and culturally feasible: structural changes through strengthening the mandate of Bappeda's sustainability coordination, for example through the Regent Regulation that regulates the mechanism for synchronizing planning, data integration, and facilitation of technical recommendations from the relevant regional apparatus, without placing Bappeda as an environmental technical approval agency; procedural changes through Regional-Based Thematic Musrenbang that is more deliberative, inclusive, and equipped with anti-tokenism mechanisms, such as tracking community proposals to the RKPD, publication of reasons for accepting/rejecting proposals, and escorting budget priorities so that the forum does not stop as a ceremonial ritual; changes in capacity and attitudes (attitudinal) through the formation of the triple helix task force and the shift of evaluation indicators from budget absorption (output) to socio-ecological impact (outcome).

Theoretically, this study enriches the study of public administration and regional planning in Indonesia by showing the relevance of SSM as an analytical lens to understand the complexity of human activity systems in natural resource governance. This approach shifts the paradigm of regional planning studies that tend to be normative-quantitative towards an interpretive-systemic approach that places the subjectivity of actors, local political dynamics, and value conflicts as central variables.

Practically, the action plan matrix prepared in Phase 7 of SSM provides a concrete, measurable, and operational policy roadmap for the Tangerang Regency Government. The recommendations are designed to strengthen the coordination and orchestration function of

Bappeda through regional legal instruments, thematic deliberative forums, and government-academic-business-sector collaboration.

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