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Linking Rural Development Objectives and Outcome Indicators for the Purpose of Monitoring and Evaluating Rural Development in South Africa

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Abstract

Rural development is central to achieving global sustainability goals through its contributions to economic well-being, social inclusion, and environmental protection, yet its measurement remains fragmented. In South Africa, for instance, weak alignment between national priorities and municipal implementation constrains the effective monitoring of rural well-being. This study develops a framework for monitoring rural development across South Africa's three spheres of government. Rural development is conceptualised as a multidimensional process shaped by livelihood capitals operating across economic, social, and environmental dimensions and reflected in measurable well-being outcomes. Using qualitative document analysis and a structured five-step indicator selection procedure, national rural development objectives were translated into measurable outputs and outcomes. Candidate indicators were then assessed against eight quality criteria to identify indicators that are policy-relevant, methodologically sound, and spatially measurable. The resulting framework comprises ten indicators, including three economic, three social, and four environmental indicators, with one social and four environmental indicators retained as intermediate proxy measures. A pilot application in the Greater Letaba Local Municipality demonstrates the operational feasibility of the framework and highlights local trade-offs between economic underperformance, human-capital constraints, and environmental vulnerability. The study contributes a policy-anchored indicator matrix that strengthens outcome-based rural development monitoring, supports vertical policy alignment, and promotes evidence-based prioritisation aimed at improving rural well-being.

Keywords: rural development; multidimensional well-being; rural development indicators; outcome-based monitoring; sustainable livelihoods framework; monitoring and evaluation; South Africa

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1. Introduction

Rural development has been a central component of global development policy since the 1950s and gained renewed prominence during the Millennium Development Goal era through its role in poverty reduction, infrastructure provision, and improved access to social services. Today, it remains fundamental to the Sustainable Development Goals because of its contributions to poverty alleviation, education, health, and environmental sustainability [1]. Despite this prominence, many rural communities continue to face inadequate service provision, limited livelihood opportunities, and uneven infrastructure development that require targeted, place-sensitive investment [2,3].

Contemporary rural development is widely understood as a multidimensional phenomenon encompassing social, economic, and environmental processes that cannot be captured by a single indicator. Assessment frameworks, therefore, consider multiple dimensions, although they vary across countries and contexts because of differences in rural conditions, policy priorities, and data availability (see, for example, [4–7]). This heterogeneity highlights the need for integrated yet context-sensitive assessment frameworks [8].

The shift towards multidimensional assessment is grounded in the Capability Approach, which views development as the expansion of people's freedoms and opportunities [9], and the Sustainable Livelihoods Framework (SLF), which links asset endowments and structural inputs to livelihood outcomes [10]. Together, these frameworks justify moving beyond narrow economic measures towards indicators that capture well-being across multiple dimensions.

Despite these theoretical advances, many government monitoring systems remain focused on inputs and sectoral outputs, such as expenditure, compliance measures, and activity reporting. This creates an "input–output trap" in which administrative performance is visible while improvements in human well-being remain poorly measured [11]. Consequently, policymakers have limited ability to identify trade-offs, prioritise interventions, and allocate resources effectively. In South Africa, this challenge is compounded by weak alignment between national and local monitoring systems. Although the 2019–2024 Medium-Term Strategic Framework (MTSF) includes 81 national outcome indicators to monitor progress in broad development goals, these measures are not consistently disaggregated or aligned with provincial and municipal implementation strategies. This misalignment contributes to fragmented planning and weak vertical coherence in outcome measurement [12].

Although rural development indicator frameworks have been developed internationally and within South Africa, limited attention has been given to developing policy-oriented outcome indicators directly linked to DALRRD rural development objectives. Consequently, a gap remains between national rural development priorities and the indicators used to monitor progress across government spheres. This study addresses that gap by developing an indicator matrix that operationalises national rural development objectives into measurable indicators across social, economic, and environmental dimensions. Using South Africa's national rural development strategic plans as an empirical anchor, the study translates policy objectives into outcome indicators that support monitoring, planning, and vertical policy alignment across national, provincial, and local governments. Accordingly, the focus is on developing policy-oriented outcome indicators rather than directly measuring rural development itself.

The framework makes three contributions. First, it translates policy objectives into a set of final and intermediate outcome indicators that capture multidimensional rural well-being. Second, it provides a mechanism for vertically disaggregating outcomes across national, provincial, and municipal levels. Third, it supports systematic outcome monitoring and facilitates the identification of trade-offs and the prioritisation of intervention areas.

The study focuses on the translation and mapping of policy objectives rather than on empirical validation or causal attribution. National rural development objectives are mapped to theoretically expected outcomes and candidate indicators across the three spheres of government. Stakeholder validation, empirical testing, and index construction are reserved for future research. Consequently, the indicator matrix should be viewed as a conceptually grounded and operational prototype designed to support outcome-based monitoring and the alignment of rural development policies with multidimensional well-being outcomes.

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2. Materials and Methods

2.1. Conceptual Framework

The conceptual framework adopted in this article is based on the premise that rural development is a place-based process driven by integrated interventions that prioritise multidimensional development. In this context, rural development outcomes are influenced by the accumulation of localised livelihood capitals. These capitals comprise the resources and capabilities that provide the material and institutional foundations required to alter the socio-economic trajectory of rural communities [13,14]. Households draw upon these capitals to pursue livelihood strategies and generate well-being outcomes [15].

To capture how rural development translates into actual human well-being outcomes, researchers and international organisations have moved away from single metrics like regional GDP. Instead, they rely on multidimensional frameworks that group indicators into social, economic, and environmental dimensions [16].

The economic dimension plays a foundational role in rural transformation. Economic vitality depends on the ability of individuals and local institutions to generate employment, create income, and engage in productive activities without degrading the natural resource base. Expanding economic opportunities strengthens household resilience by improving access to food, shelter, healthcare, transport, and education [17]. Recent studies point out that rural economies remain highly vulnerable to climate-related shocks and structural marginalisation, reinforcing the need for place-based and context-specific economic strategies that build local resilience and productive capacity. These dynamics align with the economic outcome theme, which centres on jobs, income, productive activity, and basic needs security [3,17].

The social dimension focuses on the conditions that shape the quality of life of rural populations, including social relationships, community cohesion, personal security, and access to essential services. Social well-being is deeply intertwined with economic and environmental conditions. Household income influences access to social services, while environmental quality directly affects health and safety [17]. Recent evidence shows that inclusive governance, community participation, and strong local institutions are critical for improving social outcomes and ensuring that development interventions align with community needs. These elements correspond to the social outcome theme, which emphasises access to services, cohesion, safety, and overall quality of life [17,18].

The environmental dimension forms the ecological foundation for rural life and development. It encompasses the quality and availability of natural resources such as clean air and water, biodiversity, and green spaces, all of which are essential for human health and ecological balance. Natural resource endowments underpin rural economic activities by providing inputs for consumption and production [17,19]. However, environmental challenges such as pollution, land degradation, and climate change pose significant risks to food security, health, and long-term sustainability [20]. Recent research stresses the importance of integrating environmental considerations into rural development planning, particularly through place-based approaches that recognise the unique ecological and social dynamics of specific rural landscapes. These concerns align with the environmental outcome theme, which focuses on resource quality, ecological health, and climate resilience [3,17,21].

The rural development framework is fundamentally shaped by factors that either facilitate or impede progress, ultimately impacting overall well-being. These factors are commonly conceptualised as five forms of livelihood assets within the sustainable livelihoods framework developed by the Department for International Development (DFID) [22]:

(i) Natural capital: encompasses the stock of environmental resources such as land, water, biodiversity, food, and clean air that provide essential goods and ecosystem services.

(ii) Human capital: refers to the knowledge, skills, competencies, health, and nutrition that enable individuals to participate productively in economic and social activities, and is strengthened through formal education, informal learning, and skills training.
(iii) Financial capital: includes savings, credit, remittances, pensions, wages, and other financial resources that support consumption, investment, and the acquisition of productive assets.
(iv) Social capital: captures the networks, relationships, norms, and trust that facilitate cooperation, collective action, and the accumulation of other forms of capital.
(v) Physical capital: comprises the infrastructure and equipment such as transport networks, secure housing, water and sanitation systems, energy supply, communications, and technological tools that reduce transaction costs, improve connectivity, and enable access to essential services.

The framework suggests that outcomes arise from dynamic interactions among dimensions and assets. For example, investments in livelihood capitals can expand opportunities, which in turn improve well-being outcomes. While rural development and well-being are closely connected as both cause and outcome, the relationship is not automatic; it is shaped by policy design and is empirically observable only through the outcome-based monitoring frameworks employed to evaluate progress [3].

2.2. Outcome-Based Policy Monitoring Framework

The outcome-based approach (OBA) is a results-oriented model of public-sector performance that shifts attention from administrative compliance to measurable improvements in people's lives. It assesses whether government activities generate the intended social and economic outcomes by aligning inputs, activities, and outputs with clearly defined results, ensuring that government action is judged by the real-world changes it seeks to achieve, such as reduced poverty, improved health or better education outcomes [12].

The process of policy monitoring gives effect to this approach by using indicators to track whether resources and actions translate into progress towards government objectives [23]. In addition to measurement, indicators serve strategic functions as they guide policy design and communicate priorities and performance information to stakeholders [24,25]. Through these roles, indicators reinforce the feedback loop between implementation, learning and policy refinement.

Monitoring involves four indicator types: input, output, outcome, and impact. Each type of indicator can be used to monitor the aspects of a policy that it is designed to monitor. Inputs are the resources or policy efforts being put in, while outputs are the immediate deliverables. Outcome indicators measure the medium-term changes that occur as a direct result of policy activities and outputs, while impact indicators measure long-term structural changes resulting from sustained outcomes [12,25]. Therefore, the main implication is that effective monitoring should track the chain from inputs to outputs to outcomes, instead of treating them as interchangeable.

To make this tracking successful, the indicators must align with the structure of the policy's goals. Policy objectives vary in scope and level within a policy hierarchy. They can be arranged in hierarchical order, where lower-level objectives contribute to achieving objectives at a higher level. Generally, lower objectives are more easily affected by a single policy, while higher level ones are affected by different policies. To ensure that the indicator captures the essence of the policy objective, policy inputs should always be measured by input indicators, policy output by output indicators, and outcome by outcome indicators [25].

2.3. Rural Development Policy and the Planning System in South Africa

2.3.1. Rural Development Policy Landscape

Rural development in South Africa refers to a deliberate effort to improve the well-being and economic circumstances of rural residents, including the development of rural areas and the people who live in them [26]. Since 1994, the government has introduced a series of strategies, frameworks, and programmes aimed at addressing persistent rural challenges such as inadequate services, weak local economies, and spatial marginalisation [27]. The rural development policy landscape is anchored in four major frameworks: the Rural Development Framework (RDF), the Integrated Sustainable Rural Development Strategy (ISRDS), the Comprehensive Rural Development Programme (CRDP), and the National Development Plan (NDP).

The RDF emphasised improving the working and living conditions of rural people through targeted job creation, housing provision, infrastructure development, and land redistribution. However, the RDF's implementation faltered due to fragmented, uncoordinated, and unsustainable efforts. In response, the ISRDS was introduced to address rural poverty and underdevelopment through integrated and sustainable development. Unlike the RDF, which targeted both rural and urban areas, the ISRDS focused exclusively on rural areas. Its objectives included investment in economic and social infrastructure, human resource development, enterprise development, strengthening local government capacity, poverty alleviation, and improving the criminal justice system [27–29]. These interventions aimed to transform rural South Africa into an economically viable and socially stable sector contributing meaningfully to national GDP.

The CRDP, introduced as Strategic Priority 3 in the Medium-Term Strategic Framework, linked rural development to land and agrarian reform and food security. It responded to persistent poverty and food insecurity by promoting the optimal use and management of natural resources. The CRDP sought to improve rural living standards through integrated development and social cohesion, guided by three pillars: agrarian transformation, rural development, and land reform [30].

The NDP represents the most recent overarching national development agenda. It emphasises sustained and inclusive economic growth as the foundation for addressing unemployment, inequality, poverty, and redistribution. Within the rural context, the NDP reinforces the need for capable institutions, integrated planning, and targeted rural investment [31].

South Africa's rural policy landscape has evolved cumulatively over time. The timeline from the 1995 National Rural Development Strategy through the ISRDS (2000), CRDP (2009), NDP (2011), and the 2023 Sector Strategy illustrates how successive frameworks build on and refine earlier approaches [27]. This layering creates both opportunities and challenges for monitoring. On the one hand, it provides a rich set of policy objectives that can be mapped to outcome indicators. On the other hand, overlapping mandates and shifting institutional responsibilities complicate attribution and require careful specification of which policy inputs are expected to produce which outcomes at which scale.

2.3.2. The South African National Planning System

Understanding how rural development policies are operationalised requires an examination of South Africa's hierarchical planning and performance monitoring system coordinated by the Department of Planning, Monitoring and Evaluation (DPME) [32]. The system follows a cascading logic that links long-term national vision to short-term implementation and budget cycles (see Figure 1).

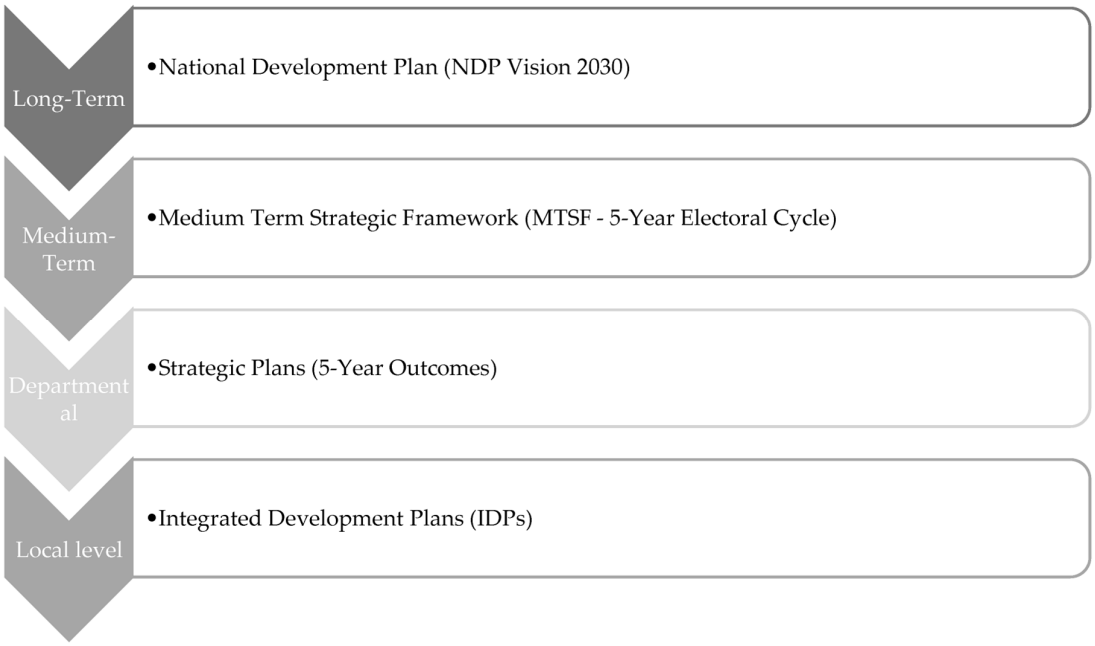


Figure 1. Implementation pathway of South Africa's NDP Vision 2030. Source: Authors' formulation.

The figure illustrates how the NDP's long-term vision is operationalised through the Medium-Term Strategic Framework (MTSF). The NDP sets the overarching 2030 vision, which is translated by the Presidency into the Medium-Term Strategic Framework (MTSF) priorities. National, provincial, and local government departments must align their five-year strategic plans, provincial growth and development strategies, and municipal integrated development plans with MTSF priorities [32]. Within this framework, the DALRRD coordinates rural development policy implementation through its five-year strategic plans. These plans outline the rural development priorities, which this study then translates into a structured indicator-matrix framework for assessing rural development outcomes.

2.4. Research Design and Data Sources

The study employed a document-based research design grounded in qualitative document analysis (QDA) to develop a set of outcome indicators for monitoring rural development in South Africa. This design is well-suited to indicator development because it enables alignment between national policy objectives, theoretical foundations, and measurable indicators that are feasible within the South African data environment [33].

The study reviewed publicly available South African policy documents and strategic plans covering the period 2009–2025. These documents translate long-term goals into five-year action plans and explicit targets and were retrieved from official government repositories. To inform candidate indicators, the study reviewed indicator sets and monitoring frameworks from international institutions (World Bank, OECD, FAO), peer-reviewed literature (sourced from Web of Science, Scopus, Google Scholar), and national statistical products by Stats SA and Quantec.

2.5. Analytical Framework for Indicator Selection

Indicator selection follows a structured five-step procedure that systematically links policy objectives to outputs and then to potential outcome indicators. These candidate indicators are assessed against a set of quality criteria, and only those that are both strongly aligned with policy priorities and spatially measurable across all spheres of government are retained. The final indicator set is organised into three dimensions, namely social, economic, and environmental.

Developing frameworks (consisting of dimensions and indicators) for measuring progress is a common practice across countries or regions. There are numerous studies that have developed these frameworks [7,34–38]. Figure 2 presents the steps recommended as a guide to developing quality indicators.

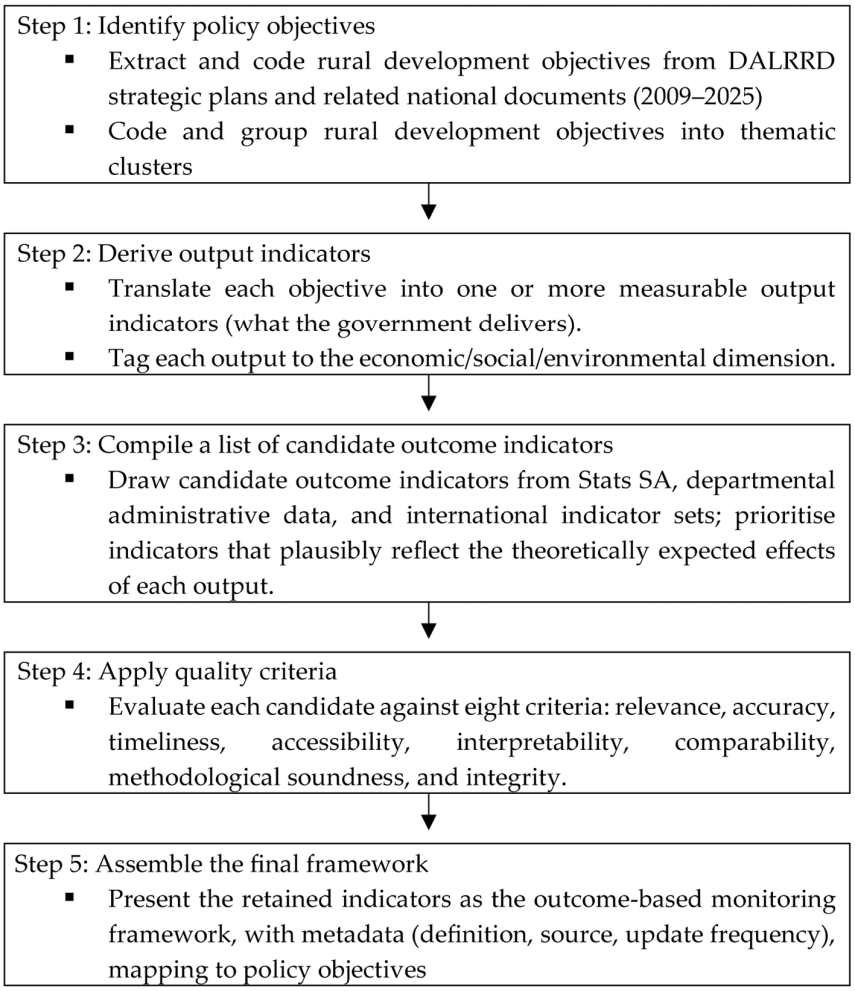


Figure 2. A structured five-step procedure for selecting the outcome indicators to measure rural development in South Africa. Source: Authors' formulation.

Step 1: Extract and code rural development objectives from DALRRD strategic plans and related national documents (2009–2025), and group objectives into thematic clusters.

Step 2: Policy objectives are a prerequisite for the selection of meaningful indicators [38]. Building on the objectives identified in Step 1, each objective was translated into one or more measurable output indicators. This produced a set of output indicators that represent government actions intended to produce outcomes. To ensure that these indicators are grounded in theory, they are then linked to the conceptual framework of rural development.

Step 3: The indicator should measure the outcome reasonably expected from a specific policy objective. Since outcomes cannot be measured by output indicators, output indicators from Step 2 become a helpful tool to find appropriate outcome indicators for the objectives identified in Step 1 [25]. This necessitated a review of the existing literature on rural development indicators, with the aim of identifying candidate outcome indicators for policy objectives.

Step 4: Each candidate indicator identified in Step 3 was evaluated against eight standard quality criteria adapted from established monitoring and evaluation frame-

works [36,38,39]. As outlined in Table 1, consideration was given to the core criteria for selecting indicators, ensuring that each selected indicator was relevant, accurate, timely, accessible, interpretable, comparable, methodologically sound, and characterised by integrity.

Table 1. Criteria for selecting rural development indicators.

Criterion	Description
Relevance	The indicator should shed light on South Africa's rural development objectives
Accuracy	The identified indicator should correctly describe the phenomena it was designed to measure
Timeliness	Data for the indicator should be released in accordance with the prescribed timeframe
Accessibility	The data for the indicator should be available and easily accessible
Interpretability	The indicator should have metadata to help users understand the data. Such information includes, among others, definitions of variables, units of measurement, data sources, and methods used to compile the indicator
Comparability and coherence	Indicators should be comparable between different sources, over time, or geographic areas
Methodological soundness	The data of the indicator should have been produced by following internationally accepted standards
Integrity	The production of the data of the indicator should consider the principle of objectivity, which is free from interference or bias

Source: [36,39].

Indicators were scored using an adapted multi-criteria compliance index (see [40,41]). Because the framework represents a first-stage prototype, scoring was conducted independently by the lead author, while stakeholder validation was reserved for subsequent research phases. To ensure robustness and operational feasibility, the study applied a conservative retention rule: indicators were retained only if they met all quality criteria (100% compliance). Where indicators were conceptually important but failed the municipal-level data test, they were documented as priority gaps for future data development.

Step 5: The final set of outcome indicators was selected based on strong alignment with South Africa's policy objectives and the availability of reliable data at the national, provincial, and municipal levels. To test operational feasibility, we applied the retained indicators in a municipal pilot (Section 3.5) using the most recent municipal-level data available from Stats SA and Quantec.

3. Results

The application of the five-step indicator selection procedure produced an empirically grounded set of outcome indicators suitable for monitoring rural development at the local municipal level in South Africa. The results show a structured refinement process that reduces a wide pool of candidate indicators, sourced from national policy, international rural development frameworks, and South African statistical datasets, into a final set that is conceptually aligned, methodologically sound, and spatially feasible.

3.1. South Africa's Rural Development Objectives

Table 2 lists all rural development objectives as stipulated in the DALRRD's strategic plans [42–45]. The rural development objectives identified across these planning periods can be grouped into five broad themes of rural development, including (i) enhancements in infrastructure, (ii) fostering economic growth and job creation, (iii) mobilising communities and building capacity, (iv) advancing social and community development, and (v) ensuring environmental sustainability.

Table 2. Rural development objectives from the DALRRD strategic plan.

Period	Objective (obj)
2009–2012	Improved economic infrastructure: obj 1. Roads, Railways, Ports; obj 2. Shearing sheds; Dipping tanks; Milking parlours; obj 3. Community gardens; Production/Marketing stalls; Fencing for agriculture; Storage warehouses; obj 4. Distribution and transport networks; Rural electrification; Communication networks (land lines, cell phones, radio, TV, etcetera); obj 5. Irrigation schemes for small-scale farmers; Water harvesting, water basin and water shed management systems (dams, etcetera); obj 6. Post offices and Internet cafes; Rural shopping malls. Improved social infrastructure: obj 7. Communal sanitation and ablution systems, showers, toilets, etcetera, for improved health; obj 8. Access to resourced health clinics; obj 9. Sports and recreation facilities especially for women and youth development; obj 10. Rural libraries for developing a reading nation; Rehabilitation and development of schools as Centres of Excellence; Community halls and museums; ABET centres for capacity building and skills development.
2010–2013	obj 11. Infrastructure development (economic, social, ICT, and public amenities infrastructure); obj 12. Establish community structure to support social cohesion and development; obj 13. Establish mechanisms to ensure natural resource conservation; obj 14. Establish a disaster mitigation help desk, and establish a research body to focus on rural development issues.
2011–2014	Community mobilisation and capacity building: obj 15. Profile rural wards and mobilise rural households in all municipalities; obj 16. Skilled and capacitated rural development and land reform beneficiaries (skill and capacitate); obj 17. Rural development delivery forums established; Agricultural and economic development: obj 18. Establish food gardens and agri-parks in CRDP wards by 2014; obj 19. Provide economic infrastructure in rural areas; obj 20. Establish village industries and enterprises; obj 21. Create jobs in rural areas; obj 22. Establish partnerships for economic productivity on CRDP sites; Infrastructure and technology access: obj 23. Innovative service delivery models; obj 24. Provide ICT infrastructure in rural areas.

Table 2. *Cont.*

Period	Objective (obj)
2014–2019	obj 25. Support to rural communities to produce their own food in all rural districts; obj 26. Quality infrastructure provided; obj 27. Facilitate the establishment of rural enterprises and industries; obj 28. Job creation and skills development in rural areas.
2020–2025	Agriculture development obj 29. Percentage (%) increase in the value of agricultural production; obj 30. Increase in the value of agricultural exports; obj 31. Increase in domestic use (value added) of agricultural products; obj 32. Agri-parks are fully functional; Community mobilisation and economic development obj 33. Jobs created in rural areas; obj 34. Mobilising and organising rural communities; obj 35. Supporting rural enterprises; obj 36. Operationalising the farmer production support units.

Source: [42–45].

During the period from 2009 to 2014, infrastructure development encompassing both economic infrastructure (such as roads, electricity, and irrigation systems) and social infrastructure (including schools, clinics, and libraries) served as a common objective [42,43]. The 2011/2014 DALRRD strategic plan highlighted the need for ICT infrastructure in rural areas, recognising the importance of digital connectivity. Promoting economic development in these regions through initiatives such as food gardens, agri-parks, and village industries has been a consistent goal [43–45].

Job creation has been a shared objective over different periods, focusing on addressing unemployment and improving livelihoods in rural communities. Capacity building remains a key theme, aimed at empowering beneficiaries of rural development and land reform. Throughout all periods, there has been a strong emphasis on mobilising and organising rural communities, fostering social cohesion, and encouraging participation in development processes [42,43,45]. These objectives formed the basis for deriving the output indicators presented in the next stage of the analysis.

3.2. Output Indicators Derived from Policy Objectives

Table 3 presents the indicators derived from the rural development objectives identified in the DALRRD strategic plans. The majority of these indicators are output indicators, indicating direct services or goods delivered by the programme or policy action. Notably, these goods or services are associated with key rural development drivers, including natural capital, human capital, social capital, economic capital, and physical capital.

Unlike earlier strategic plans, the 2020–2025 strategic plan included both output and outcome indicators including a percentage (%) increase in the value of agricultural production (obj. 29), an increase in the value of agricultural exports (obj. 30), an increase in domestic use (value added) of agricultural products (obj. 31), and the number of jobs created (obj. 28 & 33). Other outcome indicators identified include the percentage of rural households with access to ICT infrastructure (obj. 24), the percentage of rural households with access to innovative service delivery systems (obj. 23), access to healthcare services and the number of resourced health clinics (obj. 8), and access to communication networks (landlines, cell phones, radio, TV, etcetera) (obj. 4).

3.3. Linking Output Indicators to Rural Development Dimensions

This section synthesises the output indicators derived from South Africa's rural development objectives and links them to the contemporary conceptual framework of rural development. Consistent with the international literature, the indicators for measuring rural development were clustered into three broad dimensions: economic, social, and environmental [36].

Table 3. Output indicators (OI) derived from objectives (obj) of rural development within DALRRD strategic plans.

Capital Category	OI Code	Related Objective(s)	Indicator
Physical and economic capital	EC1.1	1; 4; 11	Length of new roads, railways, ports, distribution networks, and communication networks constructed.
	EC2.1	2	Number of shearing sheds, dipping tanks, and milking parlours built or upgraded.
	EC2.2	3	Length of fencing installed for agriculture.
	EC2.3	3	Number of storage warehouses constructed.
	EC2.4	18; 32	Number of food gardens, agri-parks, and fully functional agri-parks established.
	EC2.5	25	Number of rural households receiving support to produce their own food.
	EC3.1	3	Number of production/marketing stalls established.
	EC3.2	20; 27	Number of village industries and rural enterprises created.
	EC3.3	27; 35	Number of rural enterprises supported.
	EC4.1	6	Number of post offices and Internet cafés established.
	EC4.2	6	Number of rural shopping malls built.
	EC5.1	4; 11	Number of houses connected to electricity and ICT infrastructure.
	EC6.1	14; 13; 17	Number of rural development research bodies, delivery forums, disaster mitigation help desks, and conservation bodies established.
	EC6.2	22	Number of partnerships for economic productivity.
	EC6.3	36	Number of operational farmer production support units.
	EC7.1	29	Percentage increase in the value of agricultural production.
	EC7.2	30	Increase in the value of agricultural exports.
	EC7.3	31	Increase in domestic value-added use of agricultural products.
	EC8.1	28; 33	Number of jobs created in rural areas.

Table 3. *Cont.*

Capital Category	OI Code	Related Objective(s)	Indicator
Social and human capital	SO1.1	10	Number of community halls and museums.
	SO1.2	9	Number of sports and recreation facilities for women and youth.
	SO1.3	11; 12	Number of community structures established to support social cohesion and development.
	SO1.4	15	Number of rural wards profiled and households mobilised.
	SO1.5	34	Number of rural communities mobilised and organised.
	SO2.1	7	Number of communal sanitation and ablution facilities constructed.
	SO3.1	16; 28	Number of people receiving skills and capacity development training.
	SO3.2	10	Number of ABET centres established.
	SO3.3	10	Number of rural libraries established.
	SO3.4	10	Number of schools rehabilitated as Centres of Excellence.
	SO4.1	8	Number of resourced health clinics.
Natural capital and nature conservation	NA1.1	5	Hectares of land under irrigation for small-scale farmers.
	NA1.2	5	Number of water harvesting and watershed management systems (dams, basins, etc.).
	NA2.1	12; 13	Percentage increase in natural resource conservation measures.
	NA3.1	23	Number of innovative service delivery models supporting environmental sustainability.

Note: OI = output indicator. Related objective(s) numbers correspond to the objectives in the table. Source: Authors' own compilation.

3.3.1. Economic Dimension

The economic landscape of rural South Africa is captured through indicators EC1.1 to EC8.1, which reflect the availability of physical and economic capital. These indicators collectively contribute to the economic outcome theme, which emphasises infrastructure, agricultural assets, enterprise development, services, institutional coordination, productivity, and employment.

Transport and communication infrastructure (EC1.1) enhances mobility, reduces transaction costs, and expands access to markets and services. These systems are foundational drivers of productive activity and income generation [46]. Gross fixed capital formation (EC2.1–EC2.5) reflects investments in agricultural infrastructure, including shearing sheds, dipping tanks, fencing, storage warehouses, and household food production support. Such assets expand productive capacity, stimulate local value chains, and support employment creation [47]. Rural enterprise and industrial development (EC3.1–EC3.3) fosters the diversification of livelihoods by enabling rural economies to shift from low-income subsistence production towards more diversified secondary industries [48]. Investments in production stalls, village industries, and enterprise support strengthen local industrialisation and broaden opportunities for entrepreneurship.

Access to rural services and commercial infrastructure including post offices, Internet cafés, and rural shopping malls (EC4.1–EC4.2) supports rural commerce, services, and participation in digital and retail markets. Access to electricity and ICT infrastructure (EC5.1) is essential for household welfare and for enabling small enterprises, agro processing, and digital participation. Institutional and partnership indicators (EC6.1–EC6.3) strengthen coordination, resource mobilisation, and innovation. Research bodies, delivery forums, disaster mitigation help desks, conservation institutions, and farmer production support units enhance governance capacity and enable integrated planning. These cross cutting institutional arrangements support integrated economic development by linking state, private, and community actors [49,50]. Boosting economic output and productivity (EC7.1–EC7.3) through increased agricultural production, exports, and domestic value-added processing contributes directly to rural economic growth. Employment creation (EC8.1) reflects the extent to which rural development investments translate into improved livelihoods and income security.

3.3.2. Social Dimension

The social domain was assessed using SO1.1–SO4.1 plus EC5.1, which reflect the availability of social and human capital. Together, these indicators reflect key aspects of social well-being, including cohesion, education, health, and living conditions.

(i) Social cohesion and community mobilisation (SO1.1–SO1.5)

Community halls, museums, and sports facilities (SO1.1–SO1.2) strengthen social capital by providing spaces for interaction, cultural expression, and collective activities. Community structures (SO1.3), ward profiling and household mobilisation (SO1.4), and community organisation (SO1.5) further enhance collective agency, trust, and cooperation, which are key elements of social cohesion and community stability [51–54]. These indicators reflect the extent to which rural communities are socially organised, connected, and capable of participating in development processes.

(ii) Housing quality and sanitation (SO2.1, EC5.1)

Communal sanitation and ablution facilities (SO2.1) address deficits in household sanitation and improve public health outcomes [55]. Although shared sanitation can pose health risks if poorly managed [56], such facilities remain essential in contexts where household-level infrastructure is inadequate. Access to electricity and ICT infrastructure (EC5.1) further enhances household living conditions by improving safety, enabling lighting, heating, and communication, and supporting participation in digital and economic activities. Together, these indicators reflect both service delivery performance and the broader quality of living conditions in rural settlements [57,58].

(iii) Education and health (SO3.1-SO3.4, SO4.1)

Indicators related to skills development (SO3.1), ABET centres (SO3.2), libraries (SO3.3), and rehabilitated schools (SO3.4) reflect investments in human capital formation. These facilities and programmes enhance literacy, skills acquisition, and access to knowledge resources. Health clinics (SO4.1) strengthen access to essential health services, improving well-being and reducing vulnerability. Collectively, these indicators capture the extent to which rural communities benefit from education and health services that support long-term social development, reduce skills gaps, and improve overall quality of life [59,60].

3.3.3. Environmental Dimension

The environmental domain was assessed using indicators that capture natural capital, ecological infrastructure, and conservation practices. Indicators NA1.1 to NA3.1 contribute

to the environmental outcome theme, which emphasises water management, natural resource protection, and environmental sustainability.

Water management and irrigation systems including hectares under small-scale irrigation (NA1.1) and water harvesting or watershed management structures such as dams and basins (NA1.2) support sustainable agricultural production, improve water security, and reduce vulnerability to climate variability. Natural resource conservation measures (NA2.1) protect biodiversity, reduce land degradation, and enhance long-term ecological sustainability. Conservation activities contribute to improved ecosystem functioning, soil health, and vegetation cover, all of which are essential for sustaining rural livelihoods and mitigating environmental risks associated with climate change [60]. Innovative service delivery models that support environmental sustainability (NA3.1) reflect institutional and technological approaches to managing natural resources more efficiently. These models strengthen environmental governance, promote adaptive management, and enhance community capacity to respond to ecological pressures [61]. They represent an important shift towards integrated, climate-responsive rural development. These indicators reflect the ecological conditions necessary for sustaining rural livelihoods and ensuring long-term environmental resilience.

3.4. Outcome Indicators Selection Process

The grouping of output indicators into economic, social, and environmental dimensions provided the conceptual structure for identifying appropriate outcome indicators. For each dimension, a targeted review of international rural development indicator frameworks was conducted to locate outcome indicators commonly used to measure the types of changes associated with the grouped outputs.

Frameworks from the World Bank, OECD, EU, Stats SA, and rural development indices developed for Poland, Slovakia, Vietnam, Brazil, Ukraine, Portugal, Spain, and India collectively yielded more than 400 indicators. These indicators covered economic performance, social well-being, environmental sustainability, demographic trends, and institutional capacity. Table 4 presents studies containing a rural development framework comprising dimensions and indicators for measuring or monitoring progress.

Table 4. Studies containing rural development indicators.

Year of Publication	Number of Studies	Article Author(s)
Before 2013	4	GDPRD et al. [35]; UN [62]; Michalek et al. [4]; European Commission [63]
2016	1	Kim et al. [64]
2019	1	Abreu et al. [65]
2020	2	Lobão et al. [66]; Fernández Martínez et al. [67]
2022	2	Davydenko et al. [5]; López-Penabad et al. [68]
2023	1	Singh et al. [6]
2024	1	Jež Rogelj et al. [7]

After screening for relevance and alignment with the conceptual framework, 52 indicators (11 social, 26 economic and 15 environmental indicators) remained for further analysis (see Appendix A). These indicators were classified as 7 inputs, 34 outputs, intermediate indicators or drivers, and 11 outcome or impact indicators. The reduction process followed

this classification. Of the 34 outputs, five indicators reflecting upstream economic drivers (indicators 10, 12, 13, 23, and 24 in Appendix A) were excluded from further analysis because they measure macroeconomic structures and output rather than well-being. In addition, dwelling conditions (indicator 30) were removed because they were captured by indicators 29, 18, and 36. Several other outputs were conceptually overlapping and were therefore merged, including indicators 2 and 16, indicators 3 and 17, indicators 36 and 38, indicators 44 and 45, and indicators 48, 49, and 50. This process yielded 39 indicators, comprising 7 inputs, 7 outputs, 15 intermediate outcomes, and 11 outcomes or impacts.

The 7 input indicators capture the baseline stock of resources (livelihood capitals) available to rural communities prior to new interventions. These encompass natural capital assets (agricultural land base and water resource protection measures), social capital stocks (baseline community organisation and household social structure), physical/livestock capital (livestock production structure), and financial/institutional investments (gross fixed capital formation in agriculture and R&D expenditure).

Tangible outputs (n = 7) reflect the physical infrastructure delivered by development programs, including road infrastructure quality, agricultural infrastructure availability and mechanisation, retail space access, agricultural support institutions and infrastructure, and health facility access. In turn, 15 intermediate outcomes capture the service-adoption, behavioural, and access-related shifts that occur once these outputs are delivered. Key intermediate outcomes include household grid electricity access, safe drinking water access, improved sanitation practices (such as reduced open defecation), housing quality, and the adoption of conservation technologies and renewable energy. Collectively, these outputs and intermediate outcomes serve as the operational mechanisms through which baseline capitals translate into well-being improvements.

Finally, 11 final outcome indicators measure the long-term, multidimensional impacts across economic, social, and environmental dimensions. Economic outcomes are measured using core welfare metrics, namely GDP per capita, employment status, and average household income. Social outcomes capture human development through education outcomes (literacy) and health outcomes (life expectancy), while environmental outcomes monitor broader ecological health via water body state, protected areas, biodiversity richness, forest cover, and soil erosion control.

These candidate outcome indicators were then subjected to an eight-criterion evaluation framework (see Appendix B). Indicators demonstrated varying levels of compliance, with overall scores ranging from 50% to 100%. To maintain methodological rigour, only indicators achieving 100% compliance were retained. This filtering process eliminated several conceptually desirable indicators, including irrigated area, the percentage of protected areas, rate of forest cover, biodiversity richness, soil and erosion control, and sewage discharge, due to data inaccuracies, lack of comparability, or irregular update intervals.

Because no environmental final outcome indicators achieved the municipal data availability requirements, four intermediate outcome indicators were retained as proxies. Consequently, the environmental dimension is represented by four intermediate outcome indicators that reflect household environmental pressures, such as soil contamination, air and water pollution, and service-related pathways affecting environmental quality. Given limited municipal-scale ecological data, these proxies provide a practical and policy-aligned means of capturing environmental sustainability within the rural development framework. The intermediate outcome indicators were also subjected to an eight-criterion evaluation framework (see Appendix C).

The resulting final set constitutes a multidimensional framework for monitoring rural development in South Africa (Table 5). The final selection was guided by the principle that retained indicators should measure rural well-being outcomes rather than policy

inputs, outputs, or sector-specific drivers. Preference was therefore given to indicators that (i) directly measure rural well-being outcomes, (ii) satisfied all eight quality criteria, and (iii) were consistently available across national, provincial, and municipal levels. Applying these selection principles involved choosing indicators that best represented rural well-being outcomes. Employment rate, literacy rate, life expectancy, and average household income were selected over sector-specific or input-based alternatives, as they provide broader and more direct measures of well-being rather than reflecting service access, sectoral performance or intermediate development drivers.

Table 5. Final and intermediate outcome indicators selected for monitoring rural development.

Dimension	Theme	Indicator	Definition	Primary Source(s)	Update Frequency
Economic	Employment	1. Employment rate (%)	The proportion of the working-age population (usually ages 15–64) that is currently employed.	Stats SA (QLFS); Quantec	Quarterly/annual
	Economic output	2. GDP per capita (Rand, constant 2015)	Average economic output per person.	Stats SA; Quantec	Quarterly/annual
	Income	3. Average household income (Rand, constant 2015)	Mean household income from all sources.	Stats SA; Quantec	Annual/census cycle
Social	Housing quality (Intermediate outcome)	4. Housing (% formal dwelling)	The share of households living in a formal dwelling building structure.	Stats SA; Quantec	Annual/census cycle
	Education	5. Literacy rate (%)	Measures human capital formation through literacy.	Stats SA; Quantec	Annual/census cycle
	Health	6. Life expectancy at birth (years)	Measures the number of years a newborn infant can expect to live.	Stats SA; Quantec	Annual/census/ community survey cycle
Environmental	Natural resource pressure	7. Use of wood for cooking (%)	The proportion of total households primarily using wood for cooking, linked to indoor air pollution and deforestation.	Stats SA	Census/community survey cycle
	Waste management	8. No refuse removal service (%)	Share of households without access to municipal refuse removal. Reflects risk of illegal dumping, soil contamination, and ecosystem degradation.	Stats SA; Quantec	Annual/census cycle
	Sanitation & contamination	9. Open defecation and pit latrine use (%)	Proportion of households using open defecation or unimproved pit latrines. Indicates direct environmental contamination of soil and groundwater.	Stats SA; Quantec	Annual/census cycle
	Water resource pressure	10. Access to non-piped water (%)	Proportion of households using untreated water from rivers, dams, or streams. This indicates pressure on natural water ecosystems, contamination, and unsustainable abstraction.	Stats SA; Quantec	Annual/census cycle

The framework comprises five final outcome indicators, one intermediate social outcome indicator, and four intermediate environmental outcome indicators. Although the latter do not represent ultimate environmental states, they were retained as policy-relevant proxies. The retained indicators capture economic well-being through employment conditions, GDP per capita, and household income. Social well-being is reflected in household quality, education outcomes, and health outcomes. Housing quality (% formal dwelling) is treated as an intermediate outcome indicator because it captures the quality of household physical capital and provides a proxy for improved living conditions [22]. In the South African context, formal dwellings are often associated with improved access to basic municipal services such as electricity, water, sanitation, and refuse removal, although these service connections are not guaranteed [69]. The environmental dimension is represented by intermediate outcome indicators that reflect household environmental pressures, environmental health risks, and service-related pathways affecting environmental quality. All retained indicators rely exclusively on accessible datasets from Statistics South Africa and Quantec, ensuring that the framework is replicable, policy-aligned, and suitable for longitudinal and spatial analysis.

3.5. Application of the Indicator Matrix

To assess the practical feasibility of applying the selected outcome indicators at the municipal scale, a pilot analysis was conducted using a rural municipality, namely the Greater Letaba Local Municipality, which is located in Limpopo Province, South Africa. The pilot serves three functions: (i) it demonstrates the operational applicability of the indicator matrix using real data; (ii) it evaluates the extent to which municipal-level data are available and reliable; and (iii) it illustrates how the indicators reveal multidimensional rural development conditions.

All municipal, provincial, and national values, except for indicator 7, were extracted from Quantec regional standardised estimates datasets 2024. The indicator 'use of wood for cooking' was sourced from Statistics South Africa census 2022, as this is the most recent nationally representative dataset containing household energy-use information. These sources were selected due to their reliability, spatial disaggregation, and consistency with the indicator-selection criteria applied in this study.

Table 6 presents the municipal, provincial, and national values for the 10 indicators included in the pilot, together with concise interpretations aligned with the multidimensional rural development framework.

Economic outcomes: The municipality exhibits pronounced economic underperformance. The employment rate of 25.10%, GDP per capita (R30,900), and household income (R149,335) all fall substantially below provincial and national averages. These results reflect structural constraints typical of rural economies, including limited diversification, weak labour markets, and restricted access to productive assets. The economic indicators collectively highlight the need for targeted interventions in enterprise development, agri-processing, and skills training.

Social outcomes: Social indicators reveal mixed conditions. Formal housing access (94.54%) and life expectancy (67.9 years) are relatively strong and comparable to provincial averages. However, the literacy rate (49.97%) points to significant human-capital challenges. These constraints limit employability and reduce productivity, highlighting the need for continued investment in education and skills development.

Environmental (basic services) intermediate outcomes: Environmental and service-delivery indicators reveal severe vulnerabilities. Wood fuel use (53%), lack of refuse removal (78.61%), reliance on pit latrines (80.19%), and dependence on non-piped water (8.28%) collectively indicate substantial deficits in the provision of basic services and environmental

health concerns. These conditions expose households to environmental hazards, undermine well-being, and highlight gaps in municipal infrastructure provision.

Table 6. Municipal, provincial, and national indicator values with interpretations.

Indicator	Municipal Value	Provincial Average	National Average	Interpretation
1. Employment rate (%)	25.10	26.88	37.23	Employment is far below national and slightly below provincial levels, indicating weak labour absorption and limited economic diversification.
2. GDP per capita (Rand, constant 2015)	30,900	52,868	74,838	GDP per capita is substantially below both provincial and national averages, reflecting a low-productivity rural economy.
3. Average household income (Rand, constant 2015)	149,335	205,678	214,750	Household income is significantly lower than provincial and national levels, signalling persistent poverty and constrained livelihoods.
4. Housing (% formal dwelling)	94.54	94.66	87.00	Formal housing access aligns with provincial levels and exceeds national averages, suggesting successful housing delivery.
5. Literacy rate (%)	49.97	54.85	62.17	Literacy is well below provincial and national averages, representing a critical human-capital constraint.
6. Life expectancy at birth (years)	67.9	67.8	66.5	Life expectancy aligns with provincial levels and slightly exceeds national averages, indicating stable health outcomes.
7. Use of wood for cooking (%)	53	31	2	Extremely high reliance on wood indicates energy poverty, environmental pressure, and household exposure to indoor air pollution.
8. No refuse removal service (%)	78.61	66.55	28.85	Refuse removal is severely inadequate, posing major environmental health risks and signalling municipal service-delivery failure.
9. Open defecation and pit latrine use (%)	80.19	68.98	28.52	High reliance on pit latrines indicates sanitation vulnerability and groundwater contamination risk.
10. Access to non-piped water (%)	8.28	7.84	3.87	Dependence on non-piped water exceeds the national levels, indicating water service gaps and potential exposure to unsafe sources.

The Greater Letaba application confirms that the indicator matrix can be applied at the municipal level using available data while also showing how rural development conditions differ across the economic, social, and environmental dimensions. The results highlight three main priorities: strengthening labour absorption and local economic diversification, addressing human-capital constraints through education and skills development, and improving basic service delivery to reduce environmental health risks. In addition, the matrix supports vertically aligned monitoring and evidence-based prioritisation across the national, provincial, and municipal spheres.

4. Discussion

This study applied a structured, five-step procedure to identify and refine a set of five final outcome indicators, one intermediate social outcome indicator, and four intermediate environmental outcome indicators suited for monitoring rural development in South Africa. By organising these indicators into economic, social, and environmental dimensions, the

framework aligns with international approaches to multidimensional rural development assessment while remaining grounded in South Africa's institutional and data context.

The results reinforce the view that rural development is inherently multidimensional and emerges from the continuous interaction of social, economic, and environmental processes. By explicitly linking government policy objectives to these three dimensions and their expected outcomes, the framework provides an analytical basis for tracking rural development across the national, provincial, and municipal spheres. As such, the framework serves as a tool for assessing whether observed trends are broadly consistent with policy objectives and expected development outcomes. Importantly, it enables municipalities to identify real-world trade-offs when planning public investments. For example, expanding piped water access improves sanitation uptake and health outcomes, but without parallel investment in wastewater management, it may generate localised pollution, degraded water quality, and downstream ecological risks [70]. The framework therefore functions as a decision-support tool, reminding planners that short-term infrastructure gains must be balanced against long-term social and environmental well-being.

The Greater Letaba pilot illustrates the practical applicability of the framework at the municipal level. Rather than focusing on individual indicators, the value of the framework lies in its ability to reveal interactions and trade-offs across dimensions. The pilot demonstrates how economic underperformance can coexist with relatively favourable housing and health outcomes, while environmental vulnerabilities remain pronounced. Such insights can support more integrated and evidence-based planning interventions.

A key finding is the extent to which municipal data gaps constrain outcome-based rural development monitoring. Several important indicators were excluded from the final framework because reliable municipal data do not exist. Similar constraints are frequently reported in the international literature, which consistently documents a recurring trade-off between conceptual completeness and local-level measurability [17,36,71]. This study extends this literature by identifying precisely which indicators are excluded when attempting to translate national policy ideals into municipal monitoring practice within South Africa. By pinpointing these gaps, the study underscores the need for Stats SA, DALRRD, and environmental agencies to strengthen localised data collection systems and improve the spatial resolution of administrative datasets. A related implication of these data constraints is that the environmental dimension is represented by proxy indicators rather than direct measures of ecological condition. Thus, these environmental indicators should be interpreted as proxy measures of environmental sustainability because they capture pressures on environmental systems rather than the ecological conditions themselves.

The main contribution of this study is the development of a policy-anchored and operationally measurable framework for monitoring rural development across South Africa's three spheres of government. Whereas previous studies have often examined economic, social, or environmental dimensions separately [8], the proposed framework integrates these dimensions within a single outcome-based monitoring structure directly linked to DALRRD strategic objectives of rural development. Approaches that focus on single programmes risk overlooking broader policy outcomes [2], while those relying on national aggregates may obscure local realities and spatial inequalities [72]. By prioritising indicators that are both policy relevant and spatially measurable, the framework provides a practical tool for planning, monitoring, and comparative assessment across municipalities and provinces.

5. Limitations and Future Research

Despite these contributions, the study has several limitations that should be considered when interpreting the findings. First, the indicator set was derived from DALRRD strategic plans and official statistics rather than through direct stakeholder engagement. Participatory validation involving rural development practitioners, municipal officials, and rural communities could help refine the indicators and assess their alignment with local implementation capacity. Second, uneven municipal data availability favoured indicators supported by readily accessible datasets, potentially excluding measures that may better capture rural development outcomes. Third, the framework does not quantify uncertainty or confidence levels associated with each indicator, and temporal consistency varies across datasets, which may affect trend analysis. Fourth, the study relied primarily on DALRRD strategic plans and did not incorporate policy documents from other government departments closely related to rural development, such as the Ministries of Health, Basic Education, Water and Sanitation, or Environmental Affairs, as well as provincial development plans that also influence rural development outcomes. Consequently, the indicator framework may not fully capture the reality of multisectoral coordination in rural development. Fifth, because the framework is tailored to South Africa's planning system and data environment, its application in other countries would require careful adaptation to local policy objectives, institutional arrangements, and data quality. Sixth, the indicator selection process applied a strict 100% compliance threshold across all quality criteria. Although this ensured internal consistency, the assessment was conducted by a single author, introducing potential subjectivity. Incorporating multiple raters could strengthen reliability. Seventh, the Greater Letaba pilot did not include benchmarking thresholds for classifying performance. Because the aim was to demonstrate data availability and operational feasibility rather than evaluate performance adequacy, the results should be interpreted as descriptive. Future applications could incorporate explicit thresholds or normalisation procedures to support performance assessment.

Notwithstanding these limitations, the 10-indicator framework provides a robust foundation for future research and policy design. Future studies could extend the framework by incorporating demographic dynamics, infrastructure quality measures, and transformation-oriented indicators that influence rural development trajectories. Researchers may also explore the construction of a composite rural development index to facilitate cross-municipal and cross-provincial comparisons. However, any composite index should be used alongside disaggregated indicators to ensure that trade-offs between economic, social, and environmental objectives remain visible to decision-makers. Future work should also include expanded municipal pilot testing to assess the framework's applicability across diverse rural contexts.

6. Conclusions

This study developed a multidimensional, outcome-based framework for monitoring rural development in South Africa by translating DALRRD strategic objectives into ten measurable indicators spanning economic, social, and environmental dimensions. The retained indicators capture economic well-being through employment rate, GDP per capita, and average household income; social well-being through literacy rate and life expectancy at birth, with formal housing retained as an intermediate social outcome reflecting living conditions; and environmental sustainability through proxy indicators reflecting wood use for cooking, lack of refuse-removal services, pit-latrine and open-defecation use, and reliance on non-piped water sources. Together, these indicators provide a practical, policy-anchored basis for monitoring rural development outcomes across the national, provincial, and municipal spheres of government.

The municipal pilot in Greater Letaba shows that the framework can be operationalised using currently available municipal, provincial, and national data. The application also illustrates its practical value for identifying multidimensional rural development patterns, including economic underperformance, uneven social outcomes, and environmental service-delivery vulnerabilities. In doing so, the indicator matrix supports evidence-based prioritisation and vertically aligned monitoring across the national, provincial, and municipal spheres. However, the framework remains a first-stage prototype and requires stakeholder validation and wider municipal application before it can be used as a fully institutionalised monitoring instrument.

Although several conceptually important indicators could not be retained due to gaps in municipal data availability, the framework provides a practical foundation for strengthening rural development evaluation and improving spatial comparability across provinces and municipalities. Future research should focus on stakeholder validation, expanded municipal testing across diverse rural contexts, and the inclusion of additional indicators as data availability improves. As South Africa advances its rural development agenda, the framework offers a policy-anchored tool for supporting integrated planning, monitoring, and evidence-based decision-making aimed at improving well-being in rural communities.

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Appendix A

Rural development indicators derived from the existing literature and aligned with South Africa's national rural development policy objectives.

Theme	Output Indicator Code	Literature-Based Indicators
Market access & connectivity	EC1.1	1. Road infrastructure quality (density, paved share, pavement rate) 2. Access to public services (time to hospital, school, market, transport, post office) 3. Communication access (telephone mainlines, mobile network coverage)
Agricultural infrastructure and productivity	EC2.1–EC2.5	4. Gross fixed capital formation in agriculture 5. Agricultural infrastructure availability (processing centres, storage, sheds) 6. Irrigated area (%) 7. Livestock production structure (livestock units/population) 8. Agricultural mechanisation (machinery, pumping stations, drainage) 9. Agricultural land base (agricultural area, crop & livestock area) 10. Agricultural productivity (GVA per land area) 11. GDP per capita
Enterprise development & diversification	EC3.1–EC3.3	12. Economic structure (sectoral share, structure of economy) 13. Economic diversification 14. Enterprise formation (number of enterprises, newly registered entities) 15. Access to rural finance
Access to rural services & commerce	EC4.1–EC4.2; EC5.1	16. Postal access (population served per post office) 17. Digital access (Internet cafés, mobile network coverage) 18. Rural electricity access 19. Retail access (area of retail trades)
Institutional coordination & farmer support	EC6.1–EC6.3	20. Research & development expenditure 21. Agricultural support institutions (technology centres, producer organisations) 22. Agricultural support infrastructure (irrigation canals, pumping stations, drainage)
Agricultural output & value addition	EC7.1–EC7.3	23. Agricultural value addition (exports, domestic market share, GVA contribution) 24. Crop yield (t/ha)

Theme	Output Indicator Code	Literature-Based Indicators
Employment creation	EC8.1	25. Employment status (employment rate, unemployment rate, sectoral employment, non-farm employment, employment by sex)
Income	EC1.1–EC8.1	26. Average household income
Social cohesion & community organisation	SO1.1–SO1.5	27. Community organisation (farmers' organisations, community groups) 28. Household social structure (composition, racial diversity, poverty rate)
Sanitation & living conditions	SO2.1; EC5.1	29. Sanitation access (type of toilet, sanitation coverage) 30. Dwelling conditions (electricity, water, toilet, bath/shower, heating) 31. Housing quality (type of dwelling, rooms/floor space, tenure status)
Education, literacy & skills development	SO3.1–SO3.4	32. Education access (school attendance, educational institutions) 33. Education outcomes (literacy rates)
Health access & well-being	SO4.1	34. Health access (health centres, medical institutions, practitioners) 35. Health outcomes (life expectancy)
Water management	NA1.1–NA1.2	36. Drinking water access 37. Water bodies 38. Water quality (ambient quality, wastewater treated) 39. Water resource protection (freshwater withdrawals, protection measures)
Natural resource conservation & ecological health	NA2.1	40. Protected areas 41. Biodiversity richness 42. Forest area 43. Soil and erosion control 44. Household environmental pressure (wood for cooking, waste collection) 45. Access to non-piped water

Theme	Output Indicator Code	Literature-Based Indicators
Environmental governance & sustainability innovation	NA3.1	46. Conservation technologies 47. Fertiliser & pesticide use 48. Renewable energy investment 49. Renewable energy production 50. Renewable energy share
Soil, air and water pollution	SO2.1	51. Sewage discharged to soil/water 52. Open defecation/pit latrine use

Appendix B

Evaluation of rural development outcome indicators using the eight-criterion framework.

Dimension	Theme	Indicator	Relevance	Accuracy	Timeliness	Accessibility	Interpretability	Comparability and Coherence	Methodological Soundness	Integrity	Score (%)
Economic	Employment	1. Employment rate	✓	✓	✓	✓	✓	✓	✓	✓	100
	Economic output	2. GDP per capita	✓	✓	✓	✓	✓	✓	✓	✓	100
	Income	3. Average household income	✓	✓	✓	✓	✓	✓	✓	✓	100
Social	Education	4. Education outcomes (literacy rates)	✓	✓	✓	✓	✓	✓	✓	✓	100
	Health	5. Health outcomes (life expectancy)	✓	✓	✓	✓	✓	✓	✓	✓	100

Dimension	Theme	Indicator	Relevance	Accuracy	Timeliness	Accessibility	Interpretability	Comparability and Coherence	Methodological Soundness	Integrity	Score (%)
Environmental	Conservation	6. Protected areas (%)	✓	✗	✓	✗	✓	✗	✗	✓	50.0
	Biodiversity	7. Biodiversity richness	✓	✗	✗	✓	✓	✗	✓	✓	62.5
	Forests	8. Forest area	✓	✗	✓	✗	✓	✗	✗	✓	50.0
	Soil & Land	9. Soil and erosion control	✓	✗	✗	✓	✓	✗	✓	✓	62.5
	Environmental Health	10. Sewage discharged to soil/water	✓	✗	✗	✓	✓	✗	✓	✓	62.5
	Ecological water state	11. Water bodies	✓	✗	✗	✓	✓	✗	✗	✓	50.0

Appendix C

Evaluation of rural development intermediate outcome indicators using the eight-criterion framework.

Dimension	Theme	Indicator	Relevance	Accuracy	Timeliness	Accessibility	Interpretability	Comparability & Coherence	Methodological Soundness	Integrity	Score (%)
Economic	Public services	1. Access to public and postal services	✓	✓	✓	✓	✓	✓	✓	✓	100
	digital access	2. Digital & telecommunication access	✓	✓	✓	✓	✓	✓	✓	✓	100
	Agriculture	3. Irrigated area (%)	✓	✓	✓	✓	✓	✓	✓	✓	100
	Enterprise	4. Enterprise formation	✓	✓	✓	✓	✓	✓	✓	✓	100
	Finance	5. Access to rural finance	✓	✓	✓	✓	✓	✓	✓	✓	100
	Energy	6. Rural electricity access (%)	✓	✓	✓	✓	✓	✓	✓	✓	100

Dimension	Theme	Indicator	Relevance	Accuracy	Timeliness	Accessibility	Interpretability	Comparability & Coherence	Methodological Soundness	Integrity	Score (%)
Social	Sanitation	7. Sanitation access (toilet type) (%)	✓	✓	✓	✓	✓	✓	✓	✓	100
	Housing	8. Housing quality (dwelling type) (%)	✓	✓	✓	✓	✓	✓	✓	✓	100
	Educational access	9. School attendance and enrolment rates (%)	✓	✓	✓	✓	✓	✓	✓	✓	100
	Water	10. Drinking water access and source quality (%)	✓	✓	✓	✓	✓	✓	✓	✓	100
Environmental	Household environment	11. Household environmental pressure (access to non-piped water, use of wood for cooking and no waste collection service) (%)	✓	✓	✓	✓	✓	✓	✓	✓	100
	Sanitation	12. Open defecation and pit latrine use (%)	✓	✓	✓	✓	✓	✓	✓	✓	100
	Conservation	13. Conservation technologies	✓	✗	✗	✓	✓	✗	✓	✓	62.5
	Agriculture inputs practices	14. Fertiliser and pesticide use	✓	✗	✗	✓	✓	✗	✓	✓	62.5
	Energy transition	15. Renewable energy transition and investment (renewable share and production uptake)	✓	✗	✓	✓	✓	✗	✗	✓	62.5

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