

Developing the Potential of the RI–PNG Border Area in Jayapura City and Keerom Regency, Papua Province

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Abstract

Purpose: This study aims to inventory and measure the development potential of the RI–PNG border area in Muara Tami District (Jayapura City) and Keerom Regency, and to delineate functional zones (defense and security, economy, social-culture, environment, and connectivity infrastructure) as a scientific basis for integrated border-area planning.

Research Methodology: A quantitative descriptive design was applied to seven border villages using scalogram analysis and a Development Potential Index (DPI) computed as the ratio of actual to maximum zone scores multiplied by 100. Data combined institutional secondary sources (BPS village statistics, 2023–2025) with a structured field-scoring instrument.

Results: Across all villages and zones, DPI values remained predominantly in the Very Low to Low categories; none of the border-market zones reached the Sufficient threshold (40–59). Strong social-cultural and environmental foundations consistently coexisted with critical deficits in basic services, the local economy, and border logistics and institutions.

Conclusions: The border area is asset-rich but function-locked; isolation and weak connectivity suppress otherwise substantial local potential, requiring integrated rather than sectoral intervention.

Limitations: The analysis relies on aggregate village data and expert field scoring at a single point in time, which constrains causal inference and temporal comparison.

Contributions: The DPI offers regional planners a replicable, evidence-based tool for prioritising programmes and budgets within RDTR and RPJMD frameworks in frontier regions.

1. Introduction

Legally, a state border area is the territory on the inner side along the boundary line with a neighbouring country. On land, it generally comprises administrative units at the district or village level that are often remote and isolated (Undang-Undang No. 43, 2008). This condition is driven by limited connectivity and basic infrastructure such as roads, electricity, clean water, and communication networks, leaving many border areas cut off from adequate public services and deepening developmental disparities. Managing space in border areas therefore pursues two complementary goals: safeguarding state sovereignty and jurisdiction while improving the welfare of resident communities.

To achieve these goals, two main approaches are integrated. The security approach focuses on defence, public order, and the territorial integrity of the state, whereas the welfare approach covers economic and socio-cultural development together with environmental protection (Kennedy, 2021). In Papua Province, the welfare approach is especially important because it underpins the livelihoods of communities that remain partly subsistence and nomadic. The 2022 creation of New Autonomous Regions (DOB) in Papua shortened the span of governmental control and is expected to improve the effectiveness and efficiency of planning, implementation, and supervision of regional development.

To maximise the potential of its border areas, the Provincial Government of Papua initiated an empirical academic study designed to delineate integrated development zones that balance three dimensions holistically: economy, social-culture, and environment. The economic dimension should not just chase growth figures but should instead pursue inclusive development rooted in unique local potential, such as ecotourism and culture-based creative industries that create jobs, add value, and keep communities in harmony with nature (Todaro & Smith, 2020). The socio-cultural dimension strengthens community identity, social cohesion, and customary institutions, while the environmental dimension serves as an equal foundation guided by local wisdom such as the sasi system and customary land arrangements.

The balanced and synergistic integration of these three dimensions, namely an inclusive economy, a robust social-culture, and a preserved environment, converges on a single objective: authentic sustainable development that grows from local values and context. This represents a transformative empowerment vision that positions Papuan communities not as objects of assistance but as active subjects, principal actors, and rightful owners of their own future development, built in a dignified way, rooted in culture, and fully committed to sustainability for coming generations. Realising such a model in Indonesia's frontier carries meaning far beyond economic equalisation, for it becomes a backbone of national resilience in which prosperous, culturally strong, and healthy communities form the most formidable bastion of state sovereignty at the outermost edge.

A comprehensive and inclusive study is a critical prerequisite for border management in Papua for several reasons. First, the border is unique and complex, differing significantly from other Indonesian borders in its extreme geography, dispersed and often nomadic settlement patterns, and extensive customary forests and biodiversity, so uniform development approaches risk ignoring this specific context. Second, there is an urgent need to close data and information gaps, since planning in remote frontier areas is frequently based on limited or outdated data. Third, the study is instrumental for participatory planning and policy legitimacy, recognising that the border is home to customary communities whose rights are constitutionally protected. Fourth, the study acts as an integrative planning bridge that reconciles the often-competing logics of security, economy, environment, and indigenous rights into one coherent framework. Against this background, this study inventories border potential, measures it through a Development Potential Index, and delineates functional zones as a reference for development planning in the RDTR and RPJMD of Papua Province.

The study pursues three specific objectives. The first is to inventory the potential of the border area as economic, social-cultural, environmental, and other zones, based on the characteristics and patterns of land use in the frontier. The second is to determine the economic-development, social-cultural, environmental, and other zones within the border area. The third is to provide a reference for planning the development of the border area within the Detailed Spatial Plan (RDTR) and the Regional Medium-Term Development Plan (RPJMD) of Papua Province. These objectives connect the analytical work of measuring potential to the practical task of guiding budget and programme decisions, so that the resulting zonation is usable by provincial and district planners rather than remaining a purely academic exercise.

2. Literature Review

2.1. The Concept of Border Areas

Article 1(6) of Undang-Undang No. 43 (2008) on State Territory defines a border area as the part of the state territory situated on the inner side along the boundary between Indonesia and another country, covering both land and maritime borders and commonly understood as the frontmost districts. Politically, a state border is a line of sovereignty encompassing land, sea, the resources beneath the earth, and airspace (Kase, 2020). Borders are not just imaginary lines on the earth's surface but markers that separate one jurisdiction from another, and frontier zones may or may not act as barriers in interstate relations. Districts such as Keerom, Pegunungan Bintang, Boven Digoel, and Merauke, together with Jayapura City, border directly with Papua New Guinea, while other Indonesian regions face the Philippines, Australia, Malaysia, and Singapore.

Border areas perform at least seven functions: military-strategic, economic, constitutive, national-identity, national-unity, nation-state building, and the pursuit of domestic interests (Kase, 2020). In the military-strategic function the border supports the land, sea, and air defence systems that protect the state from external threats. The economic function establishes the territory within which a state controls capital flows, cross-border trade, foreign investment, and the movement of goods. The constitutive function reflects the requirement under modern international law that a sovereign state possess clearly defined boundaries, while the national-identity and national-unity functions bind communities emotionally to the territory and help preserve cohesion. The nation-state-building function gives the state the capacity to shape national history, accepted symbols, and a shared normative and cultural identity, and the domestic-interest function sets the geographic frame within which the state pursues its political, social, economic, educational, and infrastructural goals.

In general, border areas share several characteristics: they form the front terrace of the state and therefore deserve special attention in development; they are isolated and remote, especially where political will is weak; their populations lag across many aspects of development; they are sensitive to politics and security, so stability is a precondition for progress; and their accessibility is highly limited. Constrained physical and non-physical infrastructure restricts the movement of people and goods and suppresses the development of diverse economic potential in agriculture, plantation, livestock, fisheries, tourism, and small industry, while limited human resources and weak trade networks deter investors. Adequate infrastructure is therefore a priority that is expected to raise the mobility of goods and services and to attract investment that can activate the varied economic potential of frontier regions.

2.2. Development of Border Regions and Areas

Regional development is a planned, systematic effort to use available natural, human, and man-made resources and to strengthen inter-regional linkages in order to achieve optimal, sustainable community welfare while reducing regional disparities. Several theories inform border development policy. Growth Poles theory (Perroux) holds that development begins at certain points or poles with varying intensity, from which growth is expected to spread to surrounding areas through a trickle-down effect (Higgins & Savoie, 2017; Dobrescu & Dobre, 2014). The Core–Periphery model (Friedmann) distinguishes a dominant core from a dependent, lagging periphery and aims to reduce that dominance through decentralisation and regional autonomy (Karst, 1969). Circular and Cumulative Causation (Myrdal) argues that market forces tend to widen rather than narrow disparities through backwash effects, requiring strong government intervention to channel investment toward lagging regions.

Border-area development is a specific application of regional development that also concerns sovereignty and security. Historically treated as an isolated backyard focused only on security, the modern paradigm reframes the border as the nation's front porch. Contemporary practice integrates the Border Development Trilogy: a security approach (border posts, patrols, defence infrastructure); a prosperity or welfare approach (basic infrastructure, health, education, and new growth centres such as border markets and economic zones); and an environment approach (sustainable resource management, prevention of forest encroachment, and cross-border environmental cooperation).

2.3. Real Economic Conditions of the Border

Indonesia's border areas remain a source of concern. Many suffer economic backwardness due to limited government and private programmes, and the length of land and sea borders makes regular protection difficult, so border violations, smuggling, and other illegal cross-border activities are common. A study of the RI–Timor-Leste border identified three core issues in cross-border management: demarcation of land and sea boundaries, security of the border, and development of the border area, with persistent institutional constraints (Tobu, Arman, & Mamengko, 2023). Because the RI–PNG border was established far earlier (1969) than the RI–Timor-Leste border (1999–2000), the problems facing Papuan border communities are even more pressing. A parallel pattern appears at the RI–Malaysia border in Entikong, where economic growth has not yet enabled the area to drive its surroundings, reflected in minimal connecting

infrastructure and development concentrated only at the border-crossing location (Yosada, 2020). Economic dependence on neighbouring-country products further illustrates the structural weakness of Indonesian border economies (Syafri & Al-Amin, 2024; Pangalasan, 2013).

The RI–PNG border is governed by a distinct institutional and legal framework. The Basic Agreement on Border Arrangements between Indonesia and Papua New Guinea, ratified through Keputusan Presiden No. 76 (2018), provides the bilateral foundation, while the National Master Plan for the Management of State Boundaries and Border Areas under Peraturan Presiden No. 118 (2022) sets the national planning direction. At the regional level, special-autonomy arrangements for Papua and the establishment of the provincial Border and Cooperation Management Agency assign clear mandates for managing frontier development. Recent scholarship on the RI–PNG border at Skouw in Muara Tami District emphasises that effective policy must combine security and welfare approaches rather than privileging one over the other (Ohoiwutun, 2025). This layered framework gives the present study a concrete policy anchor, since its findings are intended to feed directly into provincial spatial and medium-term development plans.

2.4. Natural Resource Protection

Natural Resource Protection is an integrated effort to manage, maintain, and restore both biological and non-biological resources and their ecosystems, ensuring sustainable availability and function for present and future generations while preserving ecological balance. It does not mean leaving resources untouched, but using them wisely. Its fundamental goals are sustainability, ecosystem balance, the prevention of damage and pollution, and inter-generational equity. Implementation rests on key principles: sustainability, the precautionary principle, the polluter-pays principle, integration across sectors, and public participation, especially of affected customary and local communities.

In practice, protection is realised through a conservation trilogy. The first element is protection of life-support systems and ecosystems, achieved through conservation areas using two main methods, namely in-situ conservation within a species' natural habitat, such as nature reserves, wildlife sanctuaries, and national parks, and ex-situ conservation outside the natural habitat, such as botanical gardens and safari parks. The second element is preservation, which seeks to keep biological diversity from extinction and often overlaps with the legal protection of rare species. The third element is sustainable utilisation, in which resources are used at a rate and in a manner that does not reduce their capacity to recover. Concrete examples include the Indonesian selective-logging-and-replanting system, under which only trees of a certain diameter may be felled and must be replaced by new planting; the setting of fishing quotas alongside a ban on destructive gear such as trawls and fish bombs; and the requirement of an environmental-impact assessment before operation and of land reclamation after a mine is closed. This framework is directly relevant to the RI–PNG border, where customary forests and high biodiversity form part of the area's principal assets.

2.5. Economic and Socio-Cultural Development

Economic development is a multidimensional process involving major changes in economic, social, and institutional structures, not simply growth in output measured by GDP or GNP (Todaro & Smith, 2020). Its main dimensions are economic growth, structural change from agriculture toward industry and services, improvement in quality of life, poverty and inequality reduction, and sustainability. Economic growth is the principal precondition because it supplies the resources needed for investment in health, education, and infrastructure, while structural change shifts the economy away from a purely agrarian base. Improvement in quality of life is captured by non-monetary indicators such as life expectancy, infant mortality, and literacy, and inclusive development requires that the benefits reach the poor and vulnerable. Common indicators include GRDP per capita, which represents the average output produced per resident in a region in one year; the Human Development Index, developed by UNDP to measure achievement in a long and healthy life, knowledge, and a decent standard of living; and the Multidimensional Poverty Index, which gauges deprivation in health, education, and living standards (UNDP, 2020).

Socio-cultural development centres on people and social relations, emphasising cultural enrichment, social cohesion, and community empowerment. The United Nations defines social development as people-centred development whose basic principle is to create an inclusive, just, and cohesive society free from poverty and vulnerability, while cultural development stresses respect for diversity, the preservation of heritage, and the role of culture as an engine rather than an obstacle of development. Its dimensions include empowerment, which raises the capacity of individuals and communities to make decisions affecting their lives; social inclusion, which secures equal access to resources and opportunities for all groups, including minorities, persons with disabilities, and women; social cohesion, which strengthens trust, solidarity, and attachment among citizens; cultural preservation and innovation, which protects language, art, and tradition while encouraging contemporary expression; and institutional capacity, which reinforces the social institutions that support community welfare. Economic and socio-cultural development are tightly linked: economic progress finances social programmes, while a healthy, educated, and cohesive society is a precondition for sustainable growth and for the equitable distribution of its benefits. Development that pursues GDP alone, while neglecting social justice, the environment, and cultural identity, will in the end fail to improve human welfare.

2.6. Spatial Use and Control

Because space is a finite resource while human needs for it keep growing and often conflict, regulation is required to achieve optimal, equitable, and sustainable spatial use. Under Undang-Undang No. 26 (2007) on Spatial Planning, spatial use is the effort to realise spatial structure and patterns in accordance with spatial plans through programmes and their financing, while spatial-use control aims to maintain orderly spatial arrangement. Spatial use seeks to translate plans into reality, to optimise the function of each parcel of land according to its capacity, to raise welfare by providing space for economic and social activity, and to prevent inter-sector conflict, for example between industry and settlement. It is realised through infrastructure provision, area development for settlement, industry, trade, and tourism, and other sectoral programmes in agriculture, forestry, mining, and marine affairs that are aligned with the spatial plan.

Spatial-use control, in turn, prevents deviation from designated functions, minimises negative environmental and social impacts, enforces the law against violations, and maintains a balance among economic, social, and environmental concerns. It relies on a set of policy instruments. Permits, such as building and location permits, are granted only where a proposal conforms to the spatial plan and serve as a control before construction begins. Incentives and disincentives steer behaviour, with incentives such as tax relief, compensation, or simplified licensing rewarding conforming use, and disincentives such as higher taxes or tighter licensing discouraging non-conforming use. Administrative sanctions provide firm responses to violations, ranging from written warnings, temporary suspension, and site closure to permit revocation and the physical restoration of spatial function through demolition of unlawful structures. The two mechanisms form a continuous cycle in which the spatial plan provides direction, spatial use implements it, and control keeps that implementation on track; without spatial use, plans remain meaningless documents, and without control, use becomes unregulated and prone to disasters such as flooding, landslides, congestion, and social conflict. Effective spatial planning therefore depends on balancing these mechanisms firmly.

2.7. Partnership and Border-Area Management

Border areas combine the dual character of a sovereignty front porch and an economically and infrastructurally lagging region, so management cannot rest with government alone but requires a partnership model. In the border context, partnership is a synergistic, mutually beneficial pentahelix collaboration among government, business (private and state-owned enterprises), academia and researchers, communities, and the media. The model recognises that each actor holds different roles and resources, and that partnership can maximise the impact of development (Kementerian Desa, PDT, dan Transmigrasi, 2016).

Government, at both central and regional levels, acts as regulator and facilitator by providing basic infrastructure such as roads, electricity, and clean water, by setting policies and regulations that support investment and social protection, and by safeguarding the security and sovereignty of the territory. Business, whether private or state-owned, serves as the engine of the economy by investing in productive sectors such as agriculture, plantation, tourism, trade, and logistics, by creating jobs and transferring technology, and by carrying out social and environmental responsibility programmes. Communities, including customary communities, are the principal subjects and beneficiaries who participate actively in planning, implementation, and supervision, take up the economic opportunities created, and protect the local environment and culture. Academia and researchers supply analysis, methods, and innovation, while the media shapes public opinion, publicises the potential and challenges of the border, and safeguards the transparency and accountability of development programmes. Effective partnership in the frontier therefore depends on aligning these complementary roles around a shared development agenda.

3. Methodology

This study uses a quantitative descriptive design to inventory and measure the development potential of the RI–PNG border area. The study sites are border villages in Muara Tami District of Jayapura City and adjacent areas of Keerom Regency, including Moso, Skouw Mabo, Skouw Sae, Skouw Yambe, Kibay, and Skofro, together with the Skouw border market. Data were drawn from institutional secondary sources, principally the BPS village-level statistical series (Kecamatan Dalam Angka) for 2023–2025 and regional GRDP and social statistics, complemented by a structured field-scoring instrument completed for each village.

Muara Tami District occupies a strategic position in Jayapura City as the district that borders directly with Papua New Guinea, which makes it a frontline where territorial sovereignty meets cross-border social and economic interaction. Its villages range from settlements close to the cross-border post and market at Skouw to more isolated communities inland, producing wide variation in service access, connectivity, and economic activity within a single district. This internal diversity, together with the presence of customary land and forest, makes the district a suitable setting for zone-based measurement, because a single average would conceal the sharp differences between villages that the zonal index is designed to reveal.

Analysis combines scalogram analysis with a Development Potential Index (DPI). The scalogram ranks villages and zones according to the availability and condition of facilities and functions across development zones. The DPI converts the scalogram result into a comparable percentage by dividing the actual zone score by the maximum possible zone score and multiplying by 100, as expressed in Formula 1.

$$DPI = (Actual\ Zone\ Score \div Maximum\ Zone\ Score) \times 100 \quad (1)$$

DPI values are interpreted on a five-level scale: Very Low (0–19), Low (20–39), Sufficient (40–59), High (60–79), and Very High (80–100). The index is computed both by sub-zone and by aggregate zone, covering five functional domains: defence and security, economic development, social-culture, environment, and connectivity infrastructure. This zonal structure allows priority interventions to be identified precisely for each village and each domain, supporting an integrated rather than sectoral development approach that accounts for the interdependence among security, the local economy, social-cultural empowerment, environmental protection, and strategic connectivity. Table 1 sets out the interpretation scale used throughout the analysis.

Table 1. Development Potential Index (DPI) interpretation scale

DPI value (%)	Category	Development interpretation
0–19	Very Low	Basic facilities and functions largely absent
20–39	Low	Partial availability; major structural gaps remain
40–59	Sufficient	Core functions present but not yet optimal

DPI value (%)	Category	Development interpretation
60–79	High	Well-developed; minor improvements needed
80–100	Very High	Near-ideal readiness across indicators

Source: Authors' adaptation of scalogram scoring conventions.

The instrument scores each sub-zone against a checklist of facilities and functions appropriate to its domain, and the actual scores are aggregated to the zone level before the index is computed. By expressing readiness as a percentage of the maximum attainable score, the DPI makes heterogeneous villages and domains directly comparable and highlights both areas approaching their ideal potential and those still severely lagging.

4. Results and Discussions

The development profile of the RI–PNG border villages is markedly uneven, with sharp contrasts between strong social-environmental foundations and structural weaknesses in basic services, the local economy, and border logistics and institutions. Muara Tami District occupies a unique and strategic position in Jayapura City, functioning as a frontline that combines territorial sovereignty with cross-border socio-economic interaction, and therefore requires a special, integrative, and long-term development approach rather than treatment identical to other urban districts. Table 2 summarises the aggregate DPI by functional zone for the surveyed villages and the border market.

Table 2. Aggregate Development Potential Index (DPI, %) by functional zone

Village	Def. & Sec.	Economy	Social-Cult.	Environ.	Connect.	Category
Moso	31.2	22.5	58.3	61.0	24.0	Low–Sufficient
Skouw Mabo	30.5	33.0	55.6	52.8	18.0	Low–Sufficient
Skouw Sae	19.4	15.2	24.1	30.5	12.0	Very Low–Low
Skouw Yambe	22.0	37.5	57.0	59.2	14.0	Low–Sufficient
Kibay	33.3	35.0	44.4	50.0	29.0	Low–Sufficient
Skofro	29.2	31.0	38.9	46.0	27.0	Low–Sufficient
Skouw Border Market	33.3	30.0	11.0	37.0	15.0	Very Low–Low

Source: Authors' computation from scalogram scores, BPS village statistics (2023–2025) and field survey.

4.1. Cross-Village Patterns of Development Potential

Across the surveyed villages, DPI values remain predominantly Very Low to Low, and in the border market none of the six assessed zones reaches the Sufficient category (40–59); the highest sub-zone value there is only 37.5 points. This indicates that border-area development as a whole is still at an early stage and faces significant multidimensional challenges. A recurring paradox emerges: villages with strong social-cultural and environmental foundations are simultaneously constrained by acute weaknesses in connectivity, logistics, and frontier institutions, so that high potential in some domains sharply exposes critical bottlenecks in others.

Kampung Moso illustrates this paradox clearly. Its social-cultural and environmental zones are comparatively strong, yet basic services and the local economy lag far behind, making the priority not building from zero but simultaneous rescue and transformation: meeting basic rights immediately while building the future on existing strengths. Skouw Mabo and Skouw Yambe are similarly asset-rich but function-locked, with robust social-cultural and basic-economic foundations neutralised by the near-absence of a functioning logistics and border-institution system; the strategic priority is to open these bottlenecks so that latent potential can flow and deliver tangible benefits. Skouw Yambe in particular resembles a house with strong social and natural foundations but no entry road and a broken gateway. Skouw Sae represents the most severe case, approaching a multidimensional development emergency in which almost all major zones are very backward and DPI values are consistently low. This reflects not only infrastructure lag but, more fundamentally, a failure to fulfil basic rights and provide minimum public services, so intervention can no longer be partial or gradual and must take the form of an integrated package addressing the root causes simultaneously. At the Skouw border market, the social-cultural zone is critically weak at little more than ten per cent, signalling marginalised community life; without immediate intervention in education, health, and social institutions, every other programme rests on a fragile foundation.

The border market deserves separate attention because it concentrates the cross-border economic function of the area. When read by sub-zone, none of its components reaches the Sufficient category, and the highest sub-zone value is only 37.5 points, which indicates that no assessed aspect approaches an ideal level of readiness. Read by aggregate zone, none of the six zones reaches Sufficient either, and all remain between Very Low and Low. This profile shows that the market, although intended as a growth centre and a symbol of cross-border interaction, is not yet supported by the basic services, logistics, and institutions needed to function effectively. Its weakness in the social-cultural zone is especially consequential, because a workforce with limited access to education and health cannot fully capture the economic opportunities that a functioning border market would create.

4.2. Zonal Findings and Priorities

Within the defence-and-security zone, villages such as Skofro record DPI values of roughly 29–33 per cent (Low). Although core facilities such as the cross-border post (PLBN), police and military posts, and border patrols are present, supporting functions including inspection posts, customs, quarantine, and logistics-access roads are often absent or non-functional, so the border's gateway role is not yet backed by complete and integrated infrastructure. In the social-culture zone, formal education facilities (primary and secondary schools) are frequently scored at zero, while health services such as community health centres and integrated service posts exist with moderate scores; cultural assets such as customary halls and art studios are present but weakly developed. The environment zone consistently records the highest scores, confirming that the natural-resource base and ecological foundation are the area's strongest assets, whereas the connectivity zone is consistently the weakest, underscoring isolation as the binding constraint.

These patterns point to a clear ordering of priorities. The first and most urgent is strengthening the social-cultural zone as the human and community foundation; education and health facilities staffed by committed professionals, reinforced by public spaces and social institutions such as community halls and citizen forums, are prerequisites for success in every other sector. The second priority is connectivity and logistics, which act as the lever that unlocks the economic and service potential trapped by isolation. The third is the local, inclusive economy, built on village-specific advantages in ecotourism, plantation, fisheries, and culture-based creative industries. Because no single zone is adequate on its own, interventions must be integrated and sequenced rather than sectoral, aligning security with welfare and embedding environmental safeguards as an equal pillar.

Kibay and Skofro occupy an intermediate position. In Kibay no zone reaches the Very High category, confirming that the village remains at a developmental stage with substantial room for acceleration, although its environmental and economic foundations are comparatively sound. In Skofro the highest

defence-and-security score is recorded for the police and military post, followed by the immigration post and logistics-access road, while inspection, customs, quarantine, and patrol functions remain at or near zero, producing a zone index in the low range and a frontier that is only partially institutionalised. Its social-culture zone shows the same signature found elsewhere: health services such as community health centres, auxiliary posts, and integrated service posts are present with moderate scores, whereas formal education facilities are largely absent, and cultural assets exist but are weakly developed. This combination of a functioning security presence, a moderate health base, and missing education and logistics functions is the characteristic profile of the RI–PNG frontier and defines the agenda for targeted investment.

Overall, the findings reframe the border not as an area poor in potential but as an asset-rich territory locked by isolation and weak key functions. Realising its potential requires positioning border communities as active subjects and rightful owners of their own development rather than passive recipients of aid, and translating local-wisdom-based vision into a valid, inclusive, and accountable operational roadmap. Success in this frontier carries meaning beyond economic equity: prosperous, culturally strong communities living in a healthy environment become the most resilient bastion of national sovereignty at the country's outermost edge.

These results can be read through the regional-development theories reviewed earlier. The concentration of facilities at the cross-border post, alongside the near-absence of supporting functions in surrounding villages, mirrors the growth-pole logic in which investment clusters at a single node without yet generating a trickle-down effect to its hinterland (Higgins & Savoie, 2017). The persistent gap between a comparatively serviced node and consistently lagging villages also reflects the core–periphery dynamic, in which peripheral settlements remain dependent and under-served (Karst, 1969). Left to market forces alone, such disparities tend to widen through backwash effects rather than narrow, which is precisely why circular and cumulative causation theory calls for deliberate state intervention to channel investment toward lagging areas (Todaro & Smith, 2020). The DPI operationalises this insight by making the spatial pattern of deprivation explicit and by identifying, zone by zone, where corrective spread effects should be directed.

The policy implication is that border development in Papua must move from a sectoral, project-by-project mode toward an integrated programme anchored in measurable targets. Inventories of village potential should inform the selection of priority commodities, ecotourism sites, and supporting infrastructure; the DPI should be embedded in the planning and budgeting cycle so that intervention locations are chosen on evidence rather than convenience; and recommendations should be adopted progressively within the RDTR, RPJMD, and annual agency work plans. Above all, the acceleration of connectivity and logistics should be treated as the principal lever for the entire development system, because without it the strong social and environmental capital documented here cannot be converted into broad-based welfare.

5. Conclusions

5.1. Conclusion

This study inventoried and measured the development potential of the RI–PNG border area in Muara Tami District and Keerom Regency using scalogram analysis and a Development Potential Index, and delineated five functional zones as a basis for integrated planning. The results show that development potential across the border villages is predominantly in the Very Low to Low categories, with no border-market zone reaching the Sufficient threshold. A consistent paradox runs through the findings: strong social-cultural and environmental foundations coexist with critical deficits in basic services, the local economy, and connectivity and border institutions. The study's objectives are met by demonstrating that the border is asset-rich yet function-locked, and that the DPI can identify, zone by zone and village by village, precisely where intervention is most needed. These findings provide a scientific and ethical basis for transforming a local-wisdom-based development vision into an operational roadmap and for prioritising connectivity, basic services, and community empowerment within provincial and district planning.

5.2. Research Limitations

The analysis relies on aggregate village-level secondary data and on expert field scoring conducted at a single point in time, which limits causal inference and temporal comparison. The DPI captures the availability and condition of facilities and functions but does not directly measure outcomes such as household income, service utilisation, or community satisfaction, and the scoring instrument inevitably carries an element of expert judgement. Coverage is also confined to selected villages in one district and adjacent Keerom areas, so generalisation to all Papuan border regions should be made with caution.

5.3. Suggestions and Directions for Future Research

Future research should integrate the DPI with spatial and econometric methods, link index values to measurable welfare outcomes, and track changes over time to evaluate the impact of interventions. Expanding the sample to additional border districts, incorporating participatory data from customary communities, and combining the index with cost-benefit and connectivity modelling would strengthen its planning value. Practically, it is recommended that the village potential inventory and DPI be integrated into regional planning and budgeting, that connectivity and logistics be prioritised as a cross-sector lever, that community and customary-institution empowerment be reinforced as social capital, and that central, provincial, and district budget allocations be synchronised along a measurable roadmap so that the Papuan border can be transformed into a sovereign, productive, and sustainable region.

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Author Contributions

M.I.: conceptualization, study design, and supervision. A.L.: methodology and data analysis. Y.H.: data collection and field instrument development. A.S.: literature review and manuscript drafting. P.N.K.: data curation, revision, and final approval. All authors read and approved the final manuscript.

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