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A study on small-size urban settlement in Likhu Rural Municipality

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Abstract

This paper explores the potential for developing small-size urban settlements in Likhu Rural Municipality, Nepal, in anticipation of population growth driven by upcoming infrastructural enhancements, notably the Mid-Hill Highway and the Tokha-Chhahare Tunnelway. The study aims to spatially analyze terrain suitability for settlement development and assess suitability based on proximity to physical and social service infrastructure and economic activity centers to identify favorable conditions for urban expansion in Likhu. Furthermore, the research seeks to propose a development concept for urban settlement in Likhu Rural Municipality, tailored to the unique geographic context of each area. Additionally, the study analyzes potential legislative provisions conducive to developing small-size urban settlements in Likhu Rural Municipality, highlighting the Town Development Act, 1988 as a guiding framework for implementing equitable land distribution and infrastructure development through the land pooling mechanism. This underscores the importance of collaborative efforts between local government and private sectors, emphasizing community engagement and adherence to legal requirements.

Keywords: Spatial Analysis; Small-size Urban Settlement in Likhu Rural Municipality; Suitability; Development Concept; Town Development Act 1988; Land Pooling

1. Introduction

In today's rapidly evolving technological landscape, the size of urban settlements plays a critical role in shaping sustainable development and quality of life. Advances in transportation, communication, and infrastructure have enabled more efficient and livable urban environments [1]. Smaller settlements can leverage technology to provide high-quality services and amenities while maintaining a human-scale environment that fosters community engagement and reduces the strain on resources typically seen in larger urban centers.

For developing countries like Nepal, an optimal size for urban settlements is crucial to balance growth and sustainability [2]. Small to medium-sized urban settlements are often more manageable, allowing for effective planning and development. They can accommodate population growth without the negative impacts of over-urbanization, such as congestion, pollution, and inadequate infrastructure. These settlements can serve as hubs of economic activity and social services, supporting rural development and reducing migration pressures on larger cities [3].

When considering the size and future infrastructural development of settlements in Nepal, several factors are paramount:

- Understanding the physical landscape to ensure suitable and sustainable development.
- Evaluating the settlement's economic activities, including agriculture, trade, and industry can support.
- Assessing current and projected population growth to plan for adequate housing, services, and employment opportunities.

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- Focusing on transportation networks and their role in linking the settlement to larger economic hubs and international borders.
- Ensuring that development does not compromise natural resources and biodiversity.

1.1. Likhu Rural Municipality as a Potential Urban Center

Likhu Rural Municipality, with its strategic location along two significant road networks—the Mid-Hill Highway and the Tokha-Chhahare Tunnelway—holds substantial potential for urban development. These infrastructure projects will improve connectivity to Kathmandu and the Chinese border at Kerung, likely spurring population growth and economic activity in the region [4].

Developing a small-size urban settlement in Likhu is essential for fostering balanced regional growth, reducing migration pressures on larger cities, and creating sustainable living environments [5]. Key aspects to consider in planning include:

- Comprehensive Infrastructure Development: Building reliable roads, utilities, healthcare, and educational facilities.
- Economic Development Strategies: Promoting local businesses and industries that can thrive in the region.
- Environmental Protection: Implementing green spaces, sustainable waste management, and conservation practices.
- Community Engagement: Involving residents in the planning process to ensure that development meets their needs and preserves cultural heritage

Likhu Rural Municipality is located in Nuwakot district within Bagmati Pradesh. It encompasses six wards with diverse topography, including plains suitable for settlement development and hilly regions presenting challenges for infrastructure expansion. The area covers approximately 47.88 square kilometers, with key geographic features including the Tadi and Likhu rivers and proximity to major transportation routes.

1.2. Why the small-size urban settlement at Likhu?

Nepal faces significant challenges related to rapid urbanization, including unplanned growth, infrastructure strain, and environmental degradation. The imminent completion of the Mid-Hill Highway and the Tokha-Chhahare Tunnelway is expected to drive population growth and economic activity in Likhu Rural Municipality. However, without proper planning, Likhu may face similar issues as other urban centers, such as Kathmandu, which struggle with overcrowding and inadequate infrastructure. Developing small-size settlements in Likhu is crucial for achieving balanced regional development, reducing rural unemployment, and preventing over-urbanization. Despite the potential for urban development, Likhu Rural Municipality faces significant challenges, including inadequate infrastructure, insufficient policy frameworks, and limited financial resources. There is a pressing need to develop a strategic plan that addresses these issues, ensuring sustainable growth and improved quality of life for its residents.

The main argument of this paper is to evaluate the effective area for settlement development in Likhu Rural Municipality by analyzing existing terrain conditions, environmental factors, and legislative provisions. To achieve these arguments, the paper must provide suitable terrain conditions for urban settlement development, proper urban development implementation systems based on legislative provisions in Nepal, and propose at least one development concept for small-size urban settlements in Likhu with appropriate allocation of land use categories.

2. Literature review

The literature for this study was gathered using a systematic approach, ensuring comprehensive coverage of both historical and contemporary perspectives. Sources included academic journals, government publications, books, and credible online resources. Keywords such as "small-size urban settlements," "urban planning in Nepal," "growth pole theory," and "land use planning" were used to search databases like JSTOR, Google Scholar, and institutional repositories. The collected literature was then organized thematically to align with the research objectives and systematically analyzed to identify key trends, gaps, and insights relevant to the development of small-size urban settlements in Likhu Rural Municipality.

The historical development of urban settlements in Nepal can be traced back to ancient civilizations and trade routes. Traditional settlements like Kathmandu, Bhaktapur, and Patan emerged as cultural and commercial hubs. The introduction of democratic governance in the 1990s and subsequent political changes have significantly influenced urban planning and development policies [6].

2.1. Importance, Challenges, and Opportunities for Small-Size Urban Settlements

Small-size urban settlements hold significant potential for balanced regional development, particularly in rural municipalities like Likhu. These settlements can act as catalysts for economic growth, improving access to services and infrastructure for surrounding rural areas [7]. Key challenges include limited infrastructure, economic vulnerability, and resource constraints. Opportunities lie in leveraging local resources, community participation, and strategic planning to enhance sustainability and resilience. The relevance to Likhu Rural Municipality involves addressing these challenges through tailored urban planning strategies that align with local needs and capacities.

2.2. Theoretical Concepts: Small Towns Theories and Models

The theoretical foundation of this research draws from several key models:

- Growth Pole Theory: This theory, as proposed by Perroux (1950), emphasizes the role of specific urban centers in driving regional economic development [8]. Applied to Likhu, it suggests that targeted investments in small urban settlements can stimulate broader rural development [9].
- Urban Functions in Rural Development (UFRD) Model: Johnson (1970) and Rondinelli & Ruddle (1978) advocate for the strategic location of urban functions to enhance rural accessibility and economic integration. This model underscores the importance of small towns as service hubs, which is directly relevant to Likhu's development strategy [10,11]
- Central Place Theory: Christaller's (1933) theory on the spatial organization of settlements provides insights into the optimal distribution of services and infrastructure, highlighting the need for hierarchical planning in small urban settlements [12].

The concept and characteristics of small towns vary globally and within Nepal. Globally, small towns are often defined by population size, economic activities, and functional roles [13]. In Nepal, small towns typically serve as administrative and market centers for their hinterlands. The characteristics include compactness, mixed land use, and a close-knit community structure. The relevance of these concepts to Likhu involves understanding its unique demographic and socio-economic context to tailor planning approaches effectively. The Planning Norms and Standards 2013 of Nepal categorize settlements with populations between 10,000 to 40,000 as sub-cities, which play a vital role in decentralized urbanization.

2.3. Land Use Planning for Small Urban Settlements in Nepal

Land use planning in Nepal aims to regulate land use to achieve social, environmental, and economic efficiency. Historical contexts have shaped urban planning practices, emphasizing the need for zoning and sustainable land management. The Government of Nepal adopted the National Land Use Policy in 2013, which was revised in 2015 to address disaster risks and secure human settlements after the 2015 earthquake. These laws provide the legal basis for urban planning, emphasizing sustainable development and the integration of local needs into planning processes.

2.4. Land Pooling: Strategic Urban Development Tool

Land pooling, or land readjustment, is a crucial tool for urban development in Nepal. It involves consolidating land from various owners, developing infrastructure, and then redistributing the land with improved amenities. This method is advantageous for both the government and landowners, as it increases land value and is financially self-sustaining [14].

Implementing land pooling projects faces challenges such as achieving consensus among landowners and managing social dynamics. Solutions involve community involvement, transparent governance, and robust regulatory frameworks. For Likhu Rural Municipality, a phased approach with feasibility studies and consensus-building is essential for successful implementation [14].

The legal framework supporting land pooling includes the Town Development Act of 1988 and the Land Acquisition Act of 1977. Policy documents like the National Urban Policy of 2007 and the National Urban Development Strategy of 2017 provide strategic guidance for implementing these projects. These laws provide the legal basis for urban planning, emphasizing sustainable development and the integration of local needs into planning processes. A total of 352.8 hectares of land with 15,960 plots have already been developed and 358.7 hectares of land are ongoing to be developed with the land pooling concept in Kathmandu Valley which shows the practical application of these projects [14].

For Likhu Rural Municipality, applying these principles and frameworks involves:

- Adopting land pooling techniques to manage urban growth and infrastructure development.

- Ensuring legal compliance with relevant acts and policies.
- Engaging the community to build consensus and facilitate smooth project implementation.
- Learning from successful projects in other parts of Nepal to adapt strategies that suit local conditions and needs.

By addressing these elements, Likhu RM can effectively manage its urbanization process, ensuring sustainable development and improved quality of life for its residents.

3. Methodology

This research employs a relativistic approach to address unplanned urbanization in Likhu Rural Municipality, blending critical positivism with comprehensive analysis and stakeholder engagement. The goal is to harmonize governmental urban development objectives with local realities rooted in Thomas Kuhn's paradigm theory, 1962, this study acknowledges urbanization's social complexity. It embraces critical realism while drawing from constructivism and interpretivism, recognizing diverse societal perceptions shaping urbanization [15]. By examining policy documents and consulting stakeholders, it aims to bridge governmental aspirations with grassroots perspectives.

This study employs a descriptive and analytical research design to evaluate the feasibility of urban settlement development in Likhu Rural Municipality. The methodology combines both qualitative and quantitative approaches to provide a comprehensive analysis of various indicators, including demographic, environmental, social, economic, and physical factors.

3.1. Methods of Analysis

- Defining the Study Area: Delineating the boundaries of Likhu Rural Municipality for focused analysis.
- Data Collection, Processing, and Analysis: Gathering secondary data on urban development indicators, convert and organizing data into usable formats for analysis, and applying analytical tools and techniques to derive slope analysis, population projections, and the assessment of social and economic indicators.
- Interpretation of Results: Interpreting the analyzed data to conclude the feasibility of urban settlement development in Likhu Rural Municipality.
- Implementation, Threats, and Opportunities: Discussing challenges faced by the local government in implementing land pooling concepts, legal provisions, policy frameworks, and the land pooling implementation process guiding urban development in Nepal. Addressing threats such as eminent domain and identifying research gaps.
- Finalization After Interpretation: Formulating conclusions and recommendations based on findings.

3.2. Data Analysis

Various urban development indicators are assessed:

- Potential Population Size: Estimating future population trends.
- Slope Suitability Analysis: Identifying suitable areas for development.
- Market Center Analysis: Evaluating economic potential and infrastructure needs.
- Proximity Analysis: Analyzing the proximity of the proposed settlement from existing physical, social, and economic activity centers.

Tools such as AutoCAD, Civil 3D, Microsoft Excel, and GIS software are utilized for data collection and analysis.

4. Findings and Discussion

Findings are categorized into existing conditions, development concepts, urban development implementation systems, and threats and opportunities, followed by discussion and recommendations. The proposed urban development concept was benchmarked against national planning standards and explored through scenario planning to visualize potential growth patterns.

The chapter concludes with a summary of findings and actionable recommendations for future research and policy implementation. This comprehensive methodology ensures a holistic understanding of urbanization in Likhu Rural Municipality and provides a roadmap for sustainable development initiatives.

4.1. Settlement Size and Zoning: Theoretical Analysis and Empirical Validation

4.1.1. Potential Population Size Analysis:

The analysis of Likhu Rural Municipality's population size indicates a relatively low current population density, considering challenging terrain features. With a current population of 17,728 and a growth rate of 0.52% per annum, projections suggest a population of around 21,000 by 2051. However, considering the development of small-sized urban settlements, the construction of the Tokha-Chhahare tunnel roadway, and the completion of the Mid-hill Highway, it is anticipated that the population growth trajectory could be significantly altered.

Urban development experts' surveys indicate that populations ranging from 10,000 to 20,000 inhabitants are deemed suitable for new settlements, with larger settlements of 20,000 to 50,000 inhabitants also considered viable. In the context of Nepal's urban development policy, settlements accommodating populations of 40,000 are classified as sub-cities according to the Planning Norms and Standards (2013). Therefore, it is recommended that Likhu RM aim to accommodate a population of 40,000 in the small-sized urban settlement. This projected population size, although aspirational, is utilized to conceptualize the development of the settlement, emphasizing the need for flexibility to accommodate potential changes.

Key Population Statistics:

- Total area of Likhu RM: 47.88 sq. km.
- Total proposed settlement development area: 8.2 sq. km.
- Present population of Likhu RM: 17,728
- Proposed population for settlement development area: 40,000 (projected for the next 30 years, aiming for sub-city status)
- Present population density of Likhu RM: 370 persons/km² (Gross)
- Proposed population density of settlement development area: 4900 persons/km²

4.2. Slope Suitability Analysis:

The slope suitability analysis for Likhu Rural Municipality, based on research by Utami et al. (2018) and Rakuasa & Somae (2022), categorizes slopes into different suitability ratings for built-up land [16,17]. Slopes ranging from 0% to 8% are highly suitable for development, while those between 8% and 15% require some technical work. Slopes exceeding 15% necessitate substantial engineering efforts, highlighting the importance of considering slope variations in settlement development planning as shown in slope suitability ratings in Table 1. In Likhu, the majority of the research area comprises slopes exceeding 15%, followed by slopes of 8% to 15%, and slopes below 8% (Figure 1). These findings underscore the high risk of landslides in areas with steep slopes, emphasizing the need for strategic urban planning to mitigate such risks [17].

Table 1 Rating for Slope Suitability of Built-up Land

Variable	Class	Rating
Slope	< 8%	Satisfactory
	8% - 15%	Marginal
	>15%	Unsatisfactory

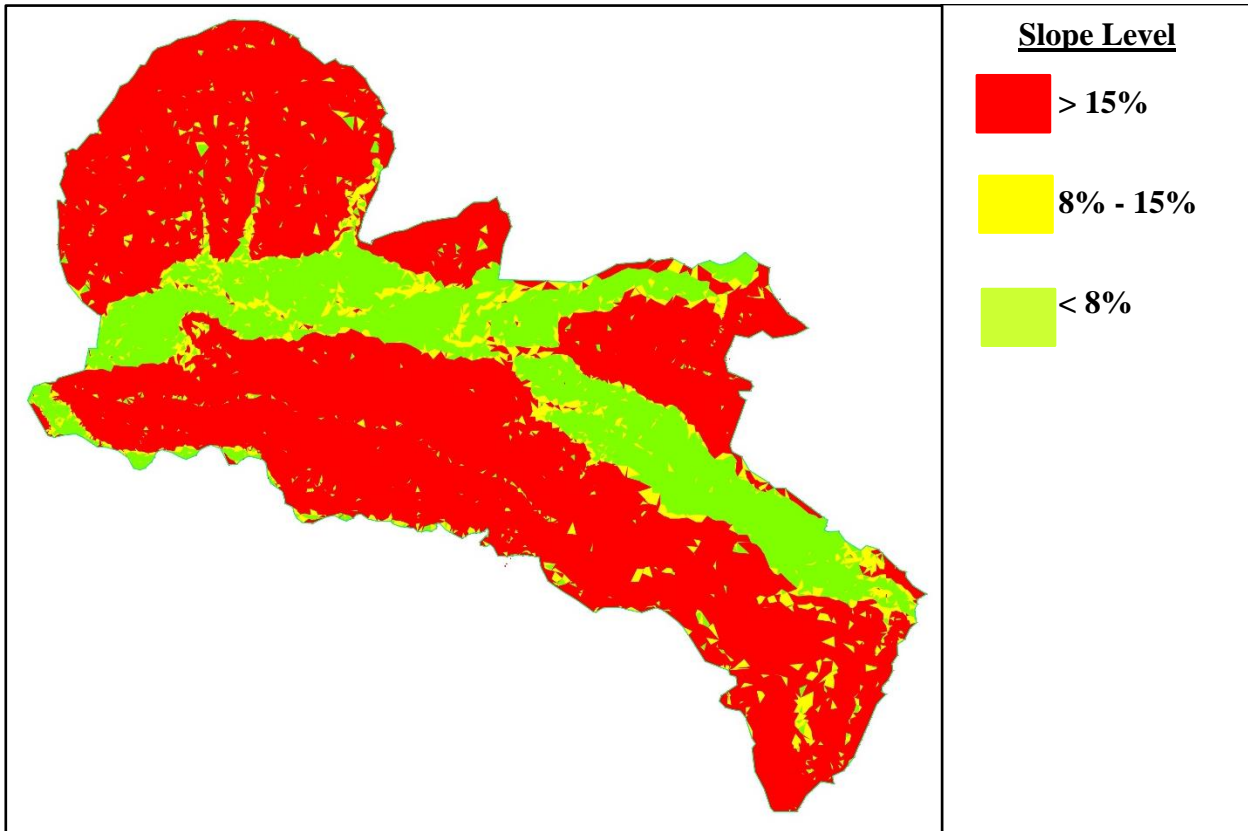


Figure 1 Slope Map of Likhu Rural Municipality

The analysis using Civil 3D V16 provides insights into the spatial distribution of slopes in Likhu Rural Municipality. Results as shown in Table 2 indicate that a significant portion of the land (76.42%) is unsuitable for urban development due to steep slopes, necessitating extensive engineering efforts for suitability. Only 5.948 sq.km. of the total area of 8.38 sq.km. is deemed suitable for settlement development, highlighting the importance of careful land use planning and conservation efforts plotted in the map in Figure 2.

Table 2 Extent of Slope

Classification	Area (sq.km.)	Percentage (%)
< 8%	8.38	17.50
9% - 15%	2.91	6.08
>15%	36.59	76.42
Total Area	47.88	100.00

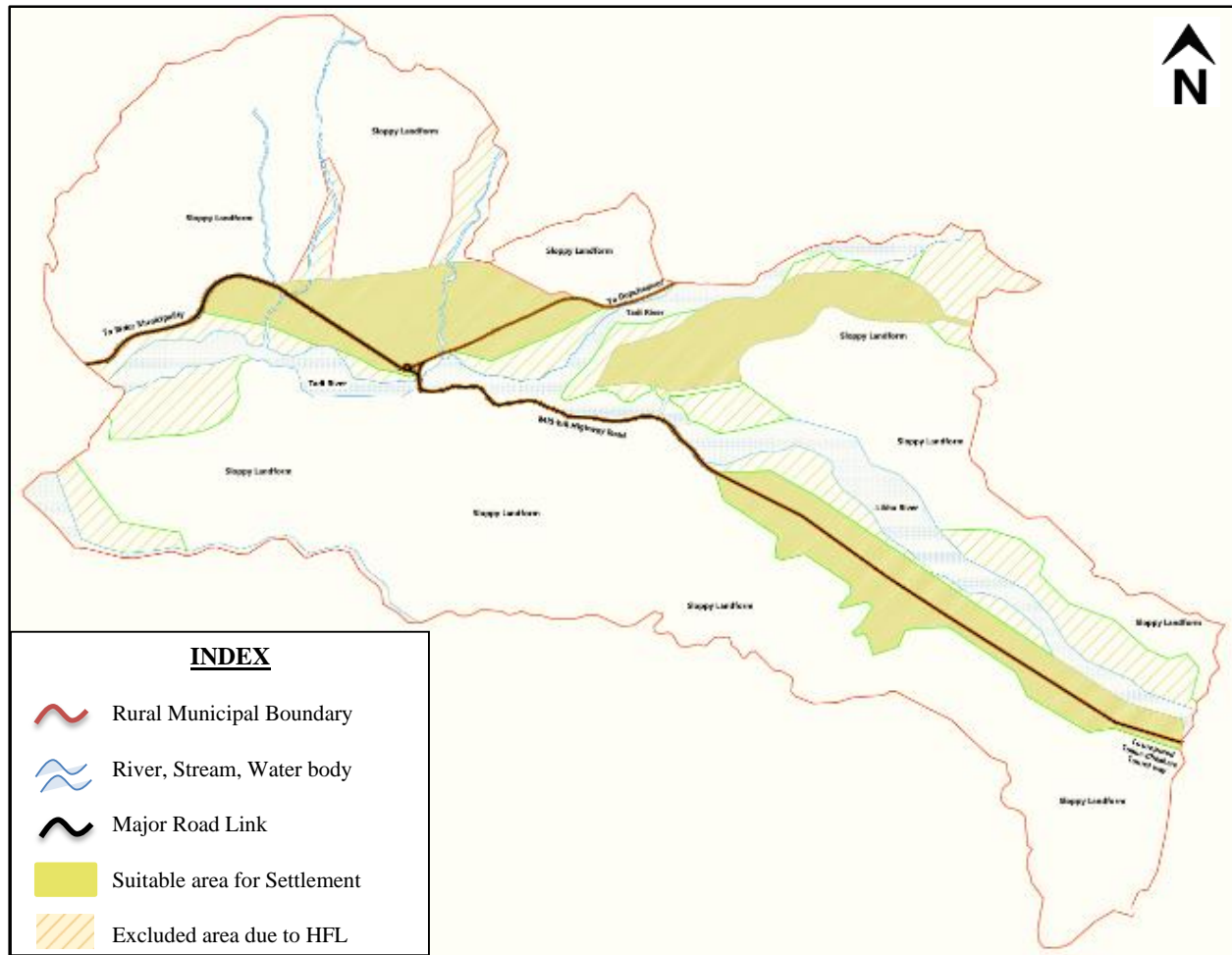


Figure 2 Suitable settlement area derived from slope suitability analysis

4.3. Market Center Analysis

The Market Center Analysis identifies three key types of areas within Likhu Rural Municipality: Urban Centers, Future Urban Centers, and Forest and Hill Areas.

- Urban Centers: Dhikure, Chaughada, and Chhahare serve as existing major market centers, distributed along key road networks. These areas require classification based on administrative divisions.
- Future Urban Centers: Surrounding each urban center are potential expansion areas for future development. Small market areas like Labdhu, Thansing, Barafedi, and Ghadkhar are identified as candidates for urban expansion.
- Forest and Hill Areas: These regions, excluding urban and market centers, are earmarked for conservation purposes to preserve wildlife, promote recreation, and support tourism.

The identified urban centers in Likhu RM serve as hubs for commerce, education, and healthcare, facilitating rural-urban linkages. According to the Urban Function and Rural Development (UFRD) model, urban centers provide essential services and functions contributing to rural development. Likewise, adhering to the Central Place Theory, these centers serve as focal points for the distribution of goods and services. From the slope suitability analysis, the area that is suitable for urban settlement development is found to be 8.38 sq. km. But this area also consists of the river flow zones and small plateaus on the hills as they also have a slope of $< 8\%$. Hence only 5.948 sq. km. is considered as suitable for urban settlement development in Likhu for further analysis.

4.3.1. Proximity from Economic Activity Center

The proximity of residents to economic activity centers is crucial for accessibility and land development suitability. Dhikure emerges as the primary hub for economic activities, supported by a diverse range of businesses and services,

followed by Chhahare and Chaughada. According to Lamonda et al. (2019), locations within a 2,000-meter radius of the center of economic activity are most suitable for land development [19]. The analysis using AutoCAD 2024 V U.61.0.0 software reveals that all areas of Likhu rural municipality's small-sized urban settlement lie within 1,000 meters of the center of economic activity (Figure 3), indicating feasibility for development with a focus on economic activities.

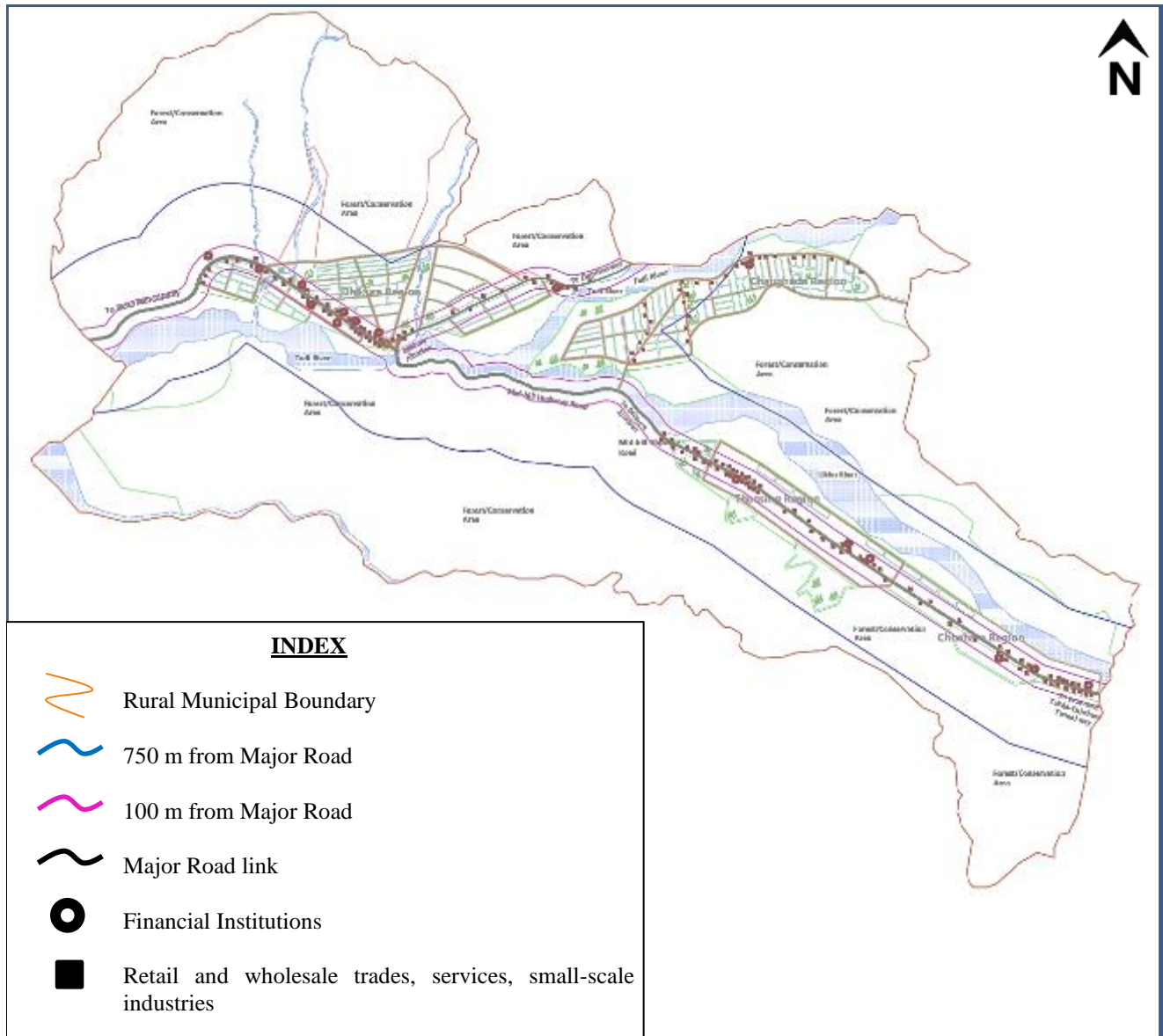


Figure 3 Spatial map of distance from the center of economic activities

Table 3 presents the extent of distance from the center of economic activity, with zones within 101 to 750 meters covering 53.88% of the total area, followed by zones within 100 meters (32.03%), and zones more than 750 meters away (14.09%). The total area analyzed is 5.948 square kilometers, with the remaining unsuitable for settlement due to factors such as river flow zones and small plateaus on hills.

Table 3 Distance from the Center of Economic Activity

Classification	Area (sq.km.)	Percentage (%)
< 100m	1.905	32.03
101 – 750m	3.205	53.88
>750m	0.838	14.09
Total Area	5.948	100.00

These findings, supported by spatial maps and analysis, provide valuable insights for urban planning and development strategies in Likhu Rural Municipality, aligning with theories of urban function and rural development.

4.3.2. Proximity from Social Institutions

The analysis of effective zones for social indicators in Likhu Rural Municipality reveals the significant presence of essential social infrastructure such as schools, healthcare facilities, and financial institutions in the major market centers of Dhikure, Chhahare, and Chaughada. These amenities enhance the quality of life for residents and contribute to the attractiveness of proposed settlement areas for new urban development.

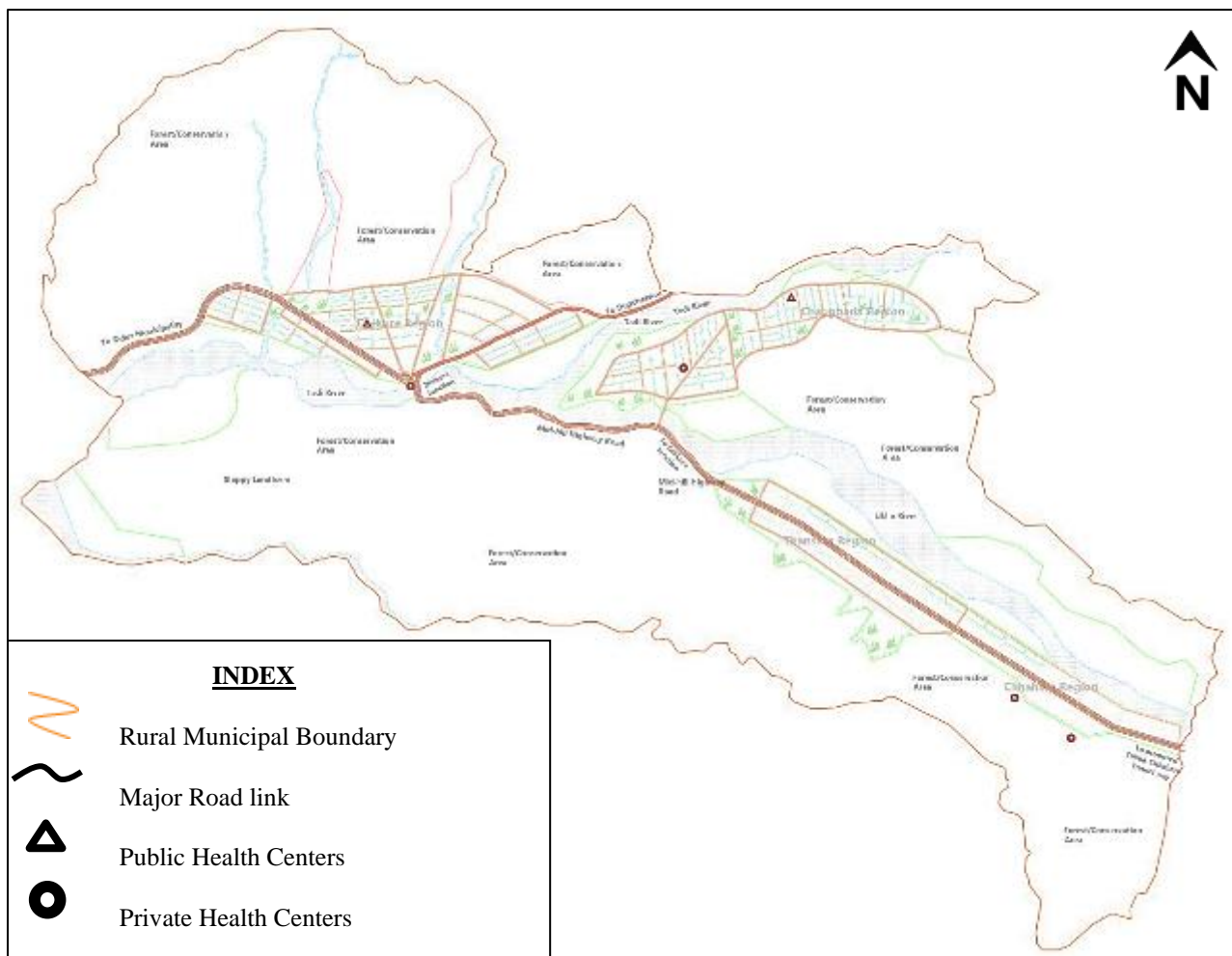


Figure 4 Spatial map indicating private and public health centers

Spatial maps (Figure 4 and Figure 5) illustrate the distribution of private and public health centers and educational institutions within the Likhu rural municipality. The presence of these institutions close to proposed settlement areas underscores their suitability for urban development.

However, the evaluation of health institutions indicates several challenges, including limited healthcare services and the absence of specialized medical treatments. With only three sub-health posts and private health clinics, residents often face difficulties accessing advanced medical care, necessitating travel to larger urban centers outside the rural municipality. To address this issue, the establishment of primary healthcare centers or district-level hospitals within or near the market centers is imperative, as per guidelines established by the Planning Norms and Standards 2013.

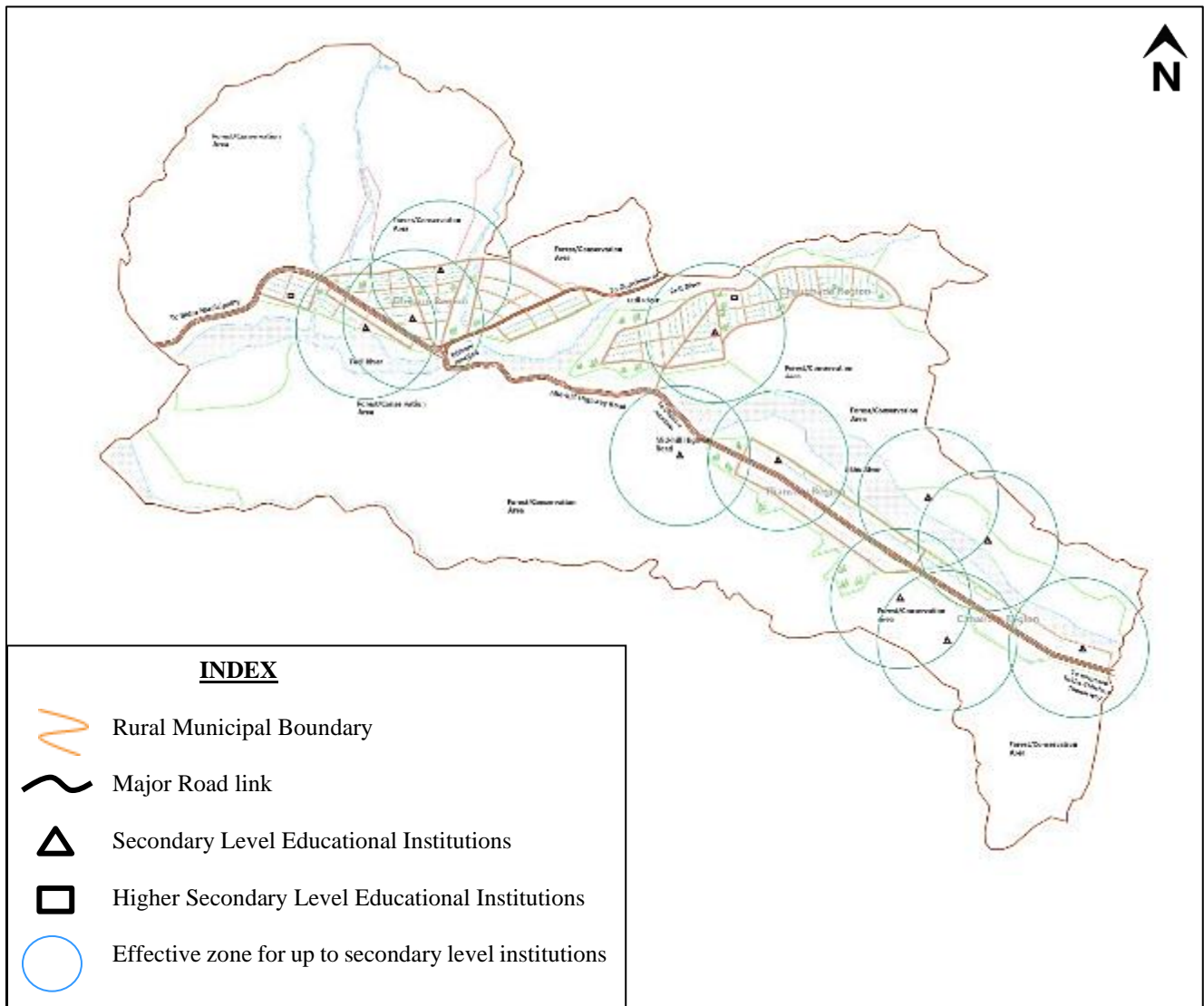


Figure 5 Spatial map indicating private and public educational institutions

Likewise, the analysis of educational institutions highlights gaps in the provision of quality education at the grassroots level. While existing higher secondary campuses in Chaughada and Dhikure Urban Center offer limited academic disciplines, they need upgrading into comprehensive university-level colleges to meet diverse educational needs and foster skill development. Additionally, the establishment of public secondary schools in each market center with modern facilities and a diverse curriculum is essential to address the shortage of quality education at the grassroots level.

4.3.3. Proximity from Major Road Links

The analysis of proximity from major road links in Likhu Rural Municipality indicates the significant role of road connectivity in shaping the distribution of built-up land. Dhikure, Chhahare, and Chaughada, as major market centers, benefit from their proximity to major road networks, facilitating mobility and economic interactions. According to research by Utami et al. (2018) and Rakuasa & Somae (2022), areas within 100 meters of major roads are highly suitable for development, while those within 101-750 meters have medium suitability [16,17]. Areas beyond 750 meters are considered more suitable for residential and industrial purposes. This classification is depicted in Table 4.

Table 4 Rating for suitability region based on the distance from Major Road Links

Variable	Class	Rating
Distance from major road links	< 100 m	Highly Suitable
	101-750m	Suitable
	>750m	More suitable for residential and industrial purpose

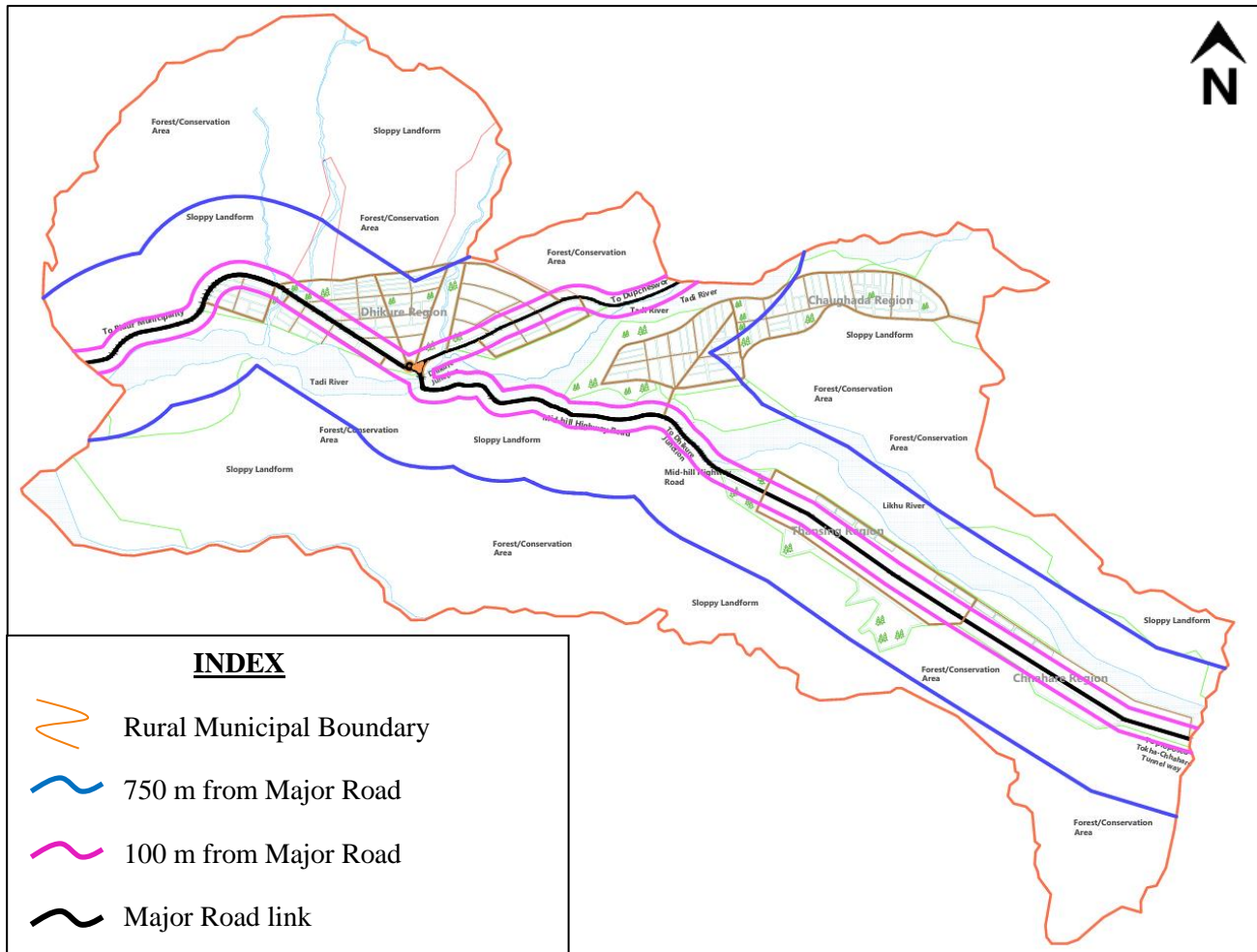


Figure 6 Spatial map showing the extent of distance from major road links

Figure 6 illustrates the spatial distribution of areas based on their distance from major road links, providing valuable insights into the relationship between road infrastructure and developed land. The analysis reveals that areas within 100 meters of major roads cover approximately 27.05% of the total research area, indicating high suitability for development.

Moreover, areas within 101 to 750 meters from major road links represent the largest portion of developed land, accounting for approximately 57.21% of the total research area. While still highly accessible to road networks, these areas may offer slightly less immediate accessibility compared to those within 100 meters.

Table 5 Distance from Major Road Links as per Figure 6

Classification	Area (sq.km.)	Percentage (%)
< 100m	1.609	27.05
101 – 750m	3.403	57.21
>750m	0.936	15.74
Total Area	5.948	100.00

Table 5 summarizes the extent of distance from major road links, highlighting the percentage of the total research area occupied by each classification. Areas beyond 750 meters constitute approximately 15.74% of the total area, characterized by relatively lower accessibility and suitability for immediate development.

Overall, the analysis underscores the influence of road proximity on the distribution of developed land in Likhu Rural Municipality. Areas closer to major roads are more likely to be developed due to their higher accessibility and convenience for transportation purposes.

The investigation into future urban centers in Likhu Rural Municipality aims to understand the hierarchical patterns of rural and urban central places across its six wards. The primary objective is to assess the influence of physical factors, such as physiographic and relief features, on the type and potentiality of settlements in the study areas.

Based on data collection and analysis, three major levels of urban conditions are identified: existing urban centers within the rural municipal areas (market centers), potential urban expansion areas on the periphery of existing market areas, and the remaining areas designated as forest or hill conservation areas. Further analysis reveals that the small marketplaces within each ward themselves represent small urban areas with self-containing urban expansion zones and adjacent conservation areas.

The schematic diagram (Figure 7) illustrates this conceptualization, with the present urban center (UC) at the core, surrounded by future urban centers (FUC) and conservation areas (C). The diagram depicts the linkage between present bazaar areas and emerging urban centers in peripheral regions, indicating a trajectory toward urbanization.

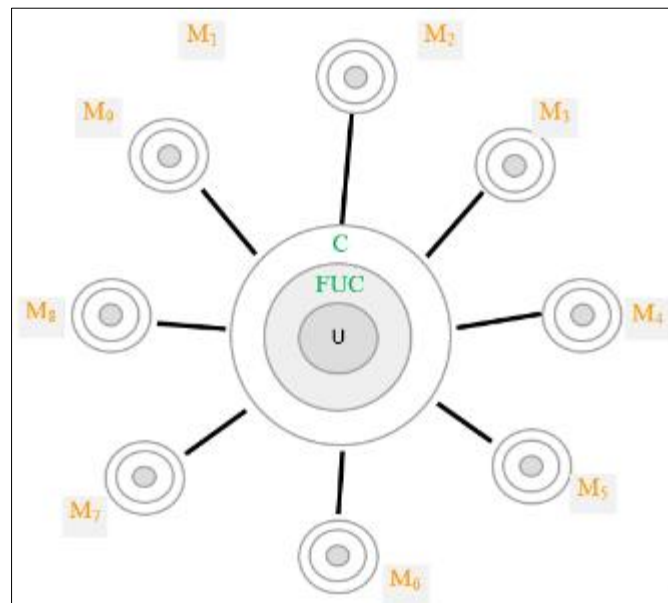


Figure 7 Schematic Diagram for Chains of Future Urban Area in Likhu

Figure 8 presents a map of Likhu, highlighting existing and proposed future urban centers. This visualization underscores the spatial distribution of urban development and the interconnectedness between central urban areas and emerging secondary urban centers.

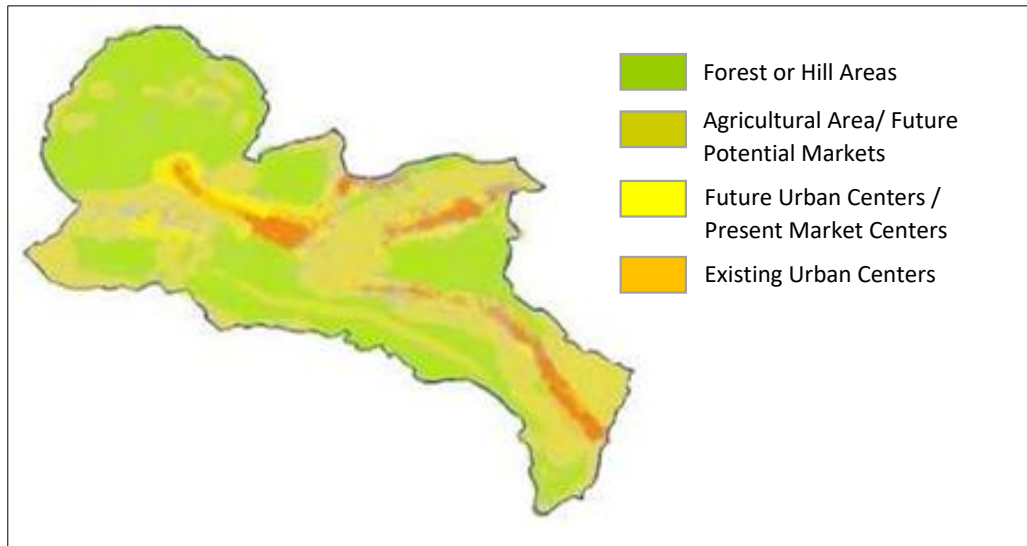


Figure 8 Map of Likhu showing existing and Proposed Future Urban Centers

Overall, the conceptualization of urban areas at the core and peripheral regions, along with the synergy between them, contributes to a sustainable urbanization perspective. The connectivity between central and peripheral urban areas fosters mutual development and enhances the overall urban landscape.

5. Proposed Development Concept

5.1. Existing Condition

The proposed urban settlement mainly encompasses paddy fields situated 50 meters from major roads and highways, lying between 580 m and 520 m above sea level. The area is bordered by high hills in the East, North, and South, covered with forests and rural settlements. To the West, it connects with Bidur Municipality via a 15-meter road, 5 km from the proposed settlement's fringe.

5.2. Development Concept

The Mid-Hill Highway and Hulaki Highway, along with a proposed tunnel connecting Thanapati and Tokha, Kathmandu, will significantly influence land development in Thansing, Chhahare, and Dhikure regions. This requires regulated urban planning to prevent land misuse and urban sprawl. The Likhu small-size urban settlement development concept focuses on three key policies:

5.2.1. Dhikure Urban Center

Located between Falate-Chokate-Haldekalika hills and the Tadi River, the development will follow a semi-radial pattern, featuring commercial zones (retail, trade, services, hotels), residential blocks (low to medium-density housing), and urban service industry zones (bus/metro stations, government offices). The area is enclosed by forest conservation zones with challenging terrain for infrastructure development.

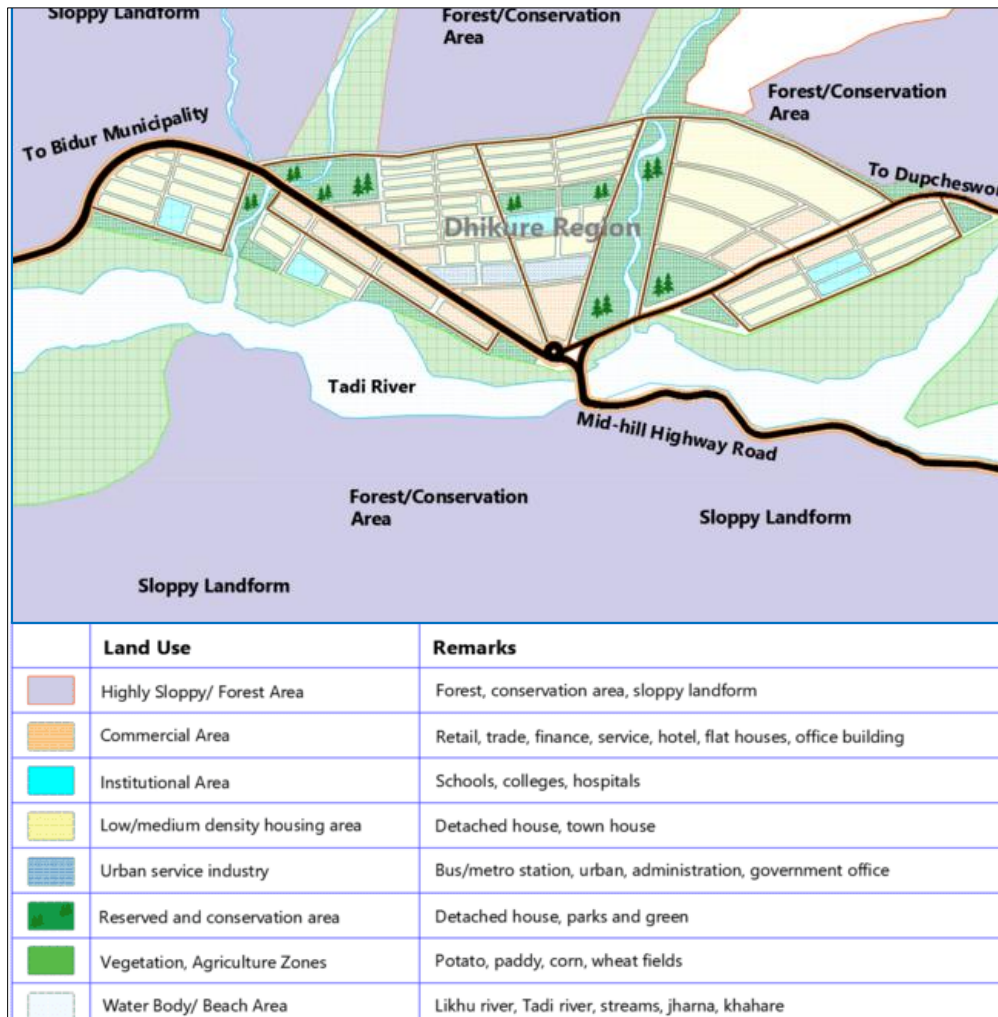


Figure 9 Development Concept of Likhu urban settlement (Dhikure section)

5.2.2. Thansing-Chhahare Urban Center

Development will proceed linearly along the Thansing-Chhahare Road to Dhikure Bazaar, focusing on commercial, institutional, and residential areas. The Likhu River flows parallel to the Mid-Hill Highway, supporting this linear development pattern. Conservation areas will be preserved, allowing for detached houses in harmony with nature.

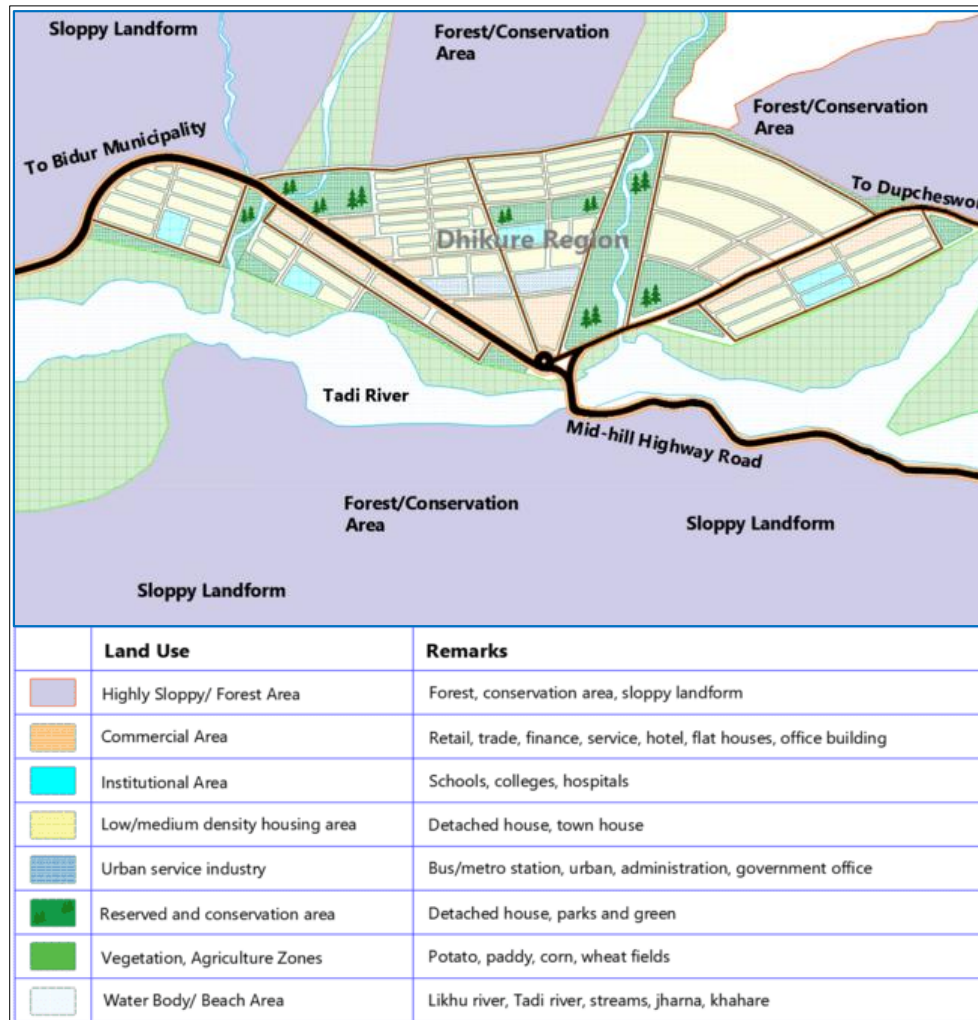


Figure 10 Development Concept of Likhu Urban Settlement (Thansing-Chhahare section)

5.2.3. Chaughada Semi Urban Center

A clustered and grid pattern will suit Chaughada, located between the Tadi and Likhu rivers. The development will focus on commercial clusters, institutional areas, and residential zones, with urban service industries planned for optimal urban amenities. The region is enclosed by rivers and forest conservation areas, presenting challenges for infrastructure development.

5.3. Urban Development Implementation System

The Likhu small-size urban settlement aims to balance public interests (affordable housing, land price stabilization, prevention of urban sprawl) with private investment. Implementation requires collaboration between local government and the private sector, following the Town Development Act of 1988. The land pooling process involves feasibility studies, consensus building, detailed project reporting, implementation, and handover stages, ensuring comprehensive planning and development.

5.4. Threats of Eminent Domain

Under the Town Development Act of 1988, the government can proceed with land development with the consent of 51% of landowners. However, the remaining 49% may be forced to participate, potentially leading to conflicts. Small landowners must either buy more land to meet minimum lot sizes or sell their land to the government, potentially missing out on the benefits of land pooling.

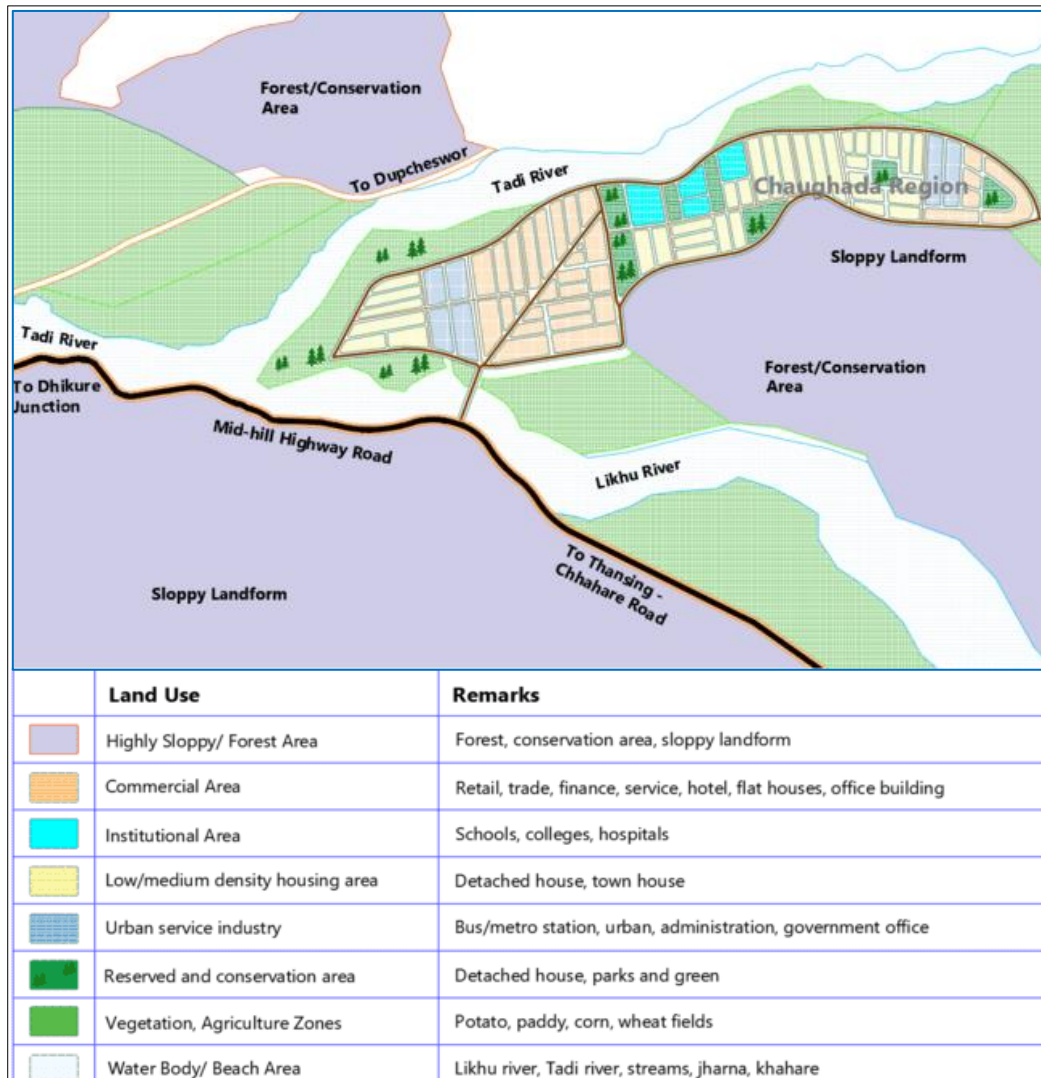


Figure 11 Development Concept of Likhu urban settlement (Chaughada section)

6. Conclusion

This research comprehensively investigates the hierarchical patterns of rural and urban central places in Likhu's six wards, emphasizing the influence of physical factors such as physiographic and relief on settlement types and future potential. The study reveals a dynamic interplay between existing market centers, potential urban expansion areas, and conservation zones, proposing a sustainable model for urbanization.

Key findings indicate that Likhu's small marketplaces are evolving into self-contained urban areas, necessitating strategic urban planning to ensure balanced growth. The proposed urban settlement areas, situated in regions with optimal elevations and agricultural potential, are positioned to leverage major infrastructural projects like the Mid-hill and Hulaki Highways and the planned tunnel connecting Nuwakot and Kathmandu. These developments promise to spur land development and economic growth but also pose challenges that require proactive urban control measures.

The development concept for Likhu focuses on three primary urban centers: Dhikure, Thansing-Chhahare, and Chaughada. Each center is designed with a distinct development pattern—semi-radial for Dhikure, linear for Thansing-Chhahare, and clustered/grid for Chaughada—reflecting their unique geographic and infrastructural contexts. These centers aim to provide a balanced mix of commercial, residential, and institutional areas while preserving natural environments and promoting sustainable urban growth.

The successful implementation of this urban development plan hinges on effective collaboration between local governments and private sectors. The land pooling mechanism, governed by the Town Development Act of 1988,

provides a structured approach for integrating landowners' interests with urban development goals. However, potential threats such as eminent domain underscore the need for careful management to ensure equitable outcomes for all stakeholders.

In conclusion, this research underscores the importance of strategic urban planning in transforming Likhu's rural landscape into a series of sustainable urban centers. By aligning infrastructural development with environmental conservation and community needs, Likhu can achieve a balanced and prosperous urban future. The proposed development framework not only addresses current urbanization challenges but also sets the stage for long-term regional development, ensuring that Likhu evolves into a model of sustainable urban growth in Nepal.

Future research should investigate long-term impacts, technological innovations, and comparative studies to enhance urban development practices further.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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Appendix

[A] Development Concept of Likhu Rural Municipality Small-size Urban Settlement

