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ASSESSING LAND USE, DELAY FACTORS, AND LAND POOLING EFFECTS IN GALCHHI, DHADING

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ABSTRACT

Land pooling (LP) has emerged as a key tool in Nepal's urban development strategy, particularly for managing unplanned growth in peri-urban and hilly regions. This study evaluates the Galchhi LP project in Dhading District using GIS analysis and stakeholder-based research to assess three dimensions: discrepancies in land coverage between GIS and cadastral data, causes of project delays, and the overall impact of LP implementation. A mixed-method approach combining spatial mapping, structured questionnaires, and key informant interviews revealed a land area mismatch of 0.77 hectares due to unregistered land use, largely agricultural and residential. Delay factors were analyzed through the Relative Importance Index (RII) and Spearman's Rank Correlation, identifying top contributors such as political bias, project management turnover, and weak institutional coordination. Despite setbacks, positive outcomes included improved infrastructure and increased land value, although concerns over land contribution ratios and prolonged timelines remain. The study highlights the need for robust institutional frameworks, updated cadastral integration with GIS, and inclusive stakeholder engagement to enhance the effectiveness of LP in Nepal's urbanizing landscape.

***Keywords**: Land Pooling, GIS, Delay Causes, Infrastructure, Impacts of Land Pooling*

1. Introduction

In recent years, Nepal's urban development efforts have increasingly focused on decentralized growth outside the Kathmandu Valleys(Government of Nepal, 2007), particularly through the introduction of planned townships supported by land pooling (LP) strategies(Yomralioglu and Parker, 1993). Galchhi, located along the Prithvi Highway and designated as one of the strategic new towns (New Town Project Coordination Office, 2014) under the National Urban Policy 2007, presents a unique case where local topography, fragmented land ownership, and institutional limitations intersect. While LP is viewed as a self-financing and equitable model, (Connellan, 2002) its implementation in hilly, peri-urban areas like Galchhi remains under-researched, especially in terms of spatial accuracy and stakeholder coordination.

Moreover, the integration of Geographic Information System (GIS) tools in LP projects has introduced both opportunities and technical challenges. While GIS allows for more precise land use mapping, (Sapkota and Bhandari, 2021) it has also exposed significant mismatches between cadastral records and ground realities (Yomralioglu and Parker, 1993). These discrepancies, when coupled with administrative inefficiencies and local resistance particularly in areas involving unregistered or Aailani land—have led to procedural delays and planning conflicts. This study builds on these contextual gaps by combining GIS analysis with stakeholder-based data to understand how land use mismatches and institutional constraints impact the progress of LP implementation in Galchhi.

Urbanization in developing countries like Nepal has led to increasing demand for systematic land management. (Faust *et al.*, 2020) The Government of Nepal has introduced land pooling as a planning tool for equitable and planned urban growth (Shrestha, 2020; GON, 2015). Several studies have emphasized the importance of GIS-based planning in resolving land use conflicts and improving infrastructure delivery in peri-urban areas (Yomralioglu & Parker, 1993).

Land pooling (LP) is a significant urban planning strategy in Nepal, especially for rapidly urbanizing areas with limited public land. (New Town Project Coordination Office, 2014) (Connellan, 2002) It enables organized development by aggregating individual plots, reallocating serviced parcels back to landowners after reserving a portion for infrastructure (ORRDP, 2017). However, the execution of LP projects is frequently delayed due to technical, legal, and political hurdles. In Galchhi, Dhading, these challenges are pronounced, where conflicts arise between GIS-based assessments and cadastral records, resulting in unregistered land disputes and stakeholder distrust.

The broader urban development strategy by the Government of Nepal (GoN), under the Town Development Act 1988, advocates land pooling. Despite legal provisions and institutional arrangements such as the New Town Project Coordination Office (NTPCO) and Town Development Committees (TDCs), implementation hurdles persist. Past LP experiences in Kathmandu Valley, Ichangu Narayan, and Pokhara reveal delays caused by political intervention, weak coordination, and resistance from landowners concerned about losing valuable land to public amenities. (Shrestha et al., 2015)

This study focuses on the Galchhi LP project to: (1) assess discrepancies in land coverage using GIS and cadastral methods, (2) identify primary causes of delay, and (3) evaluate impacts on infrastructure development. The insights derived aim to support more effective planning and execution of future LP projects in Nepal.

2. Materials and Methods

Study Area Description:

Galchhi Rural Municipality, Ward No. 4, Dhading District, is located approximately 4 km from Baireni along the Prithvi Highway. The LP project area covers 45.27 hectares and consists of diverse topography ranging from 400 to 495 meters above sea level. (Source: Field Survey and data from Land Revenue office).

Figure 1: Location map of study area.

The region is significant for its inclusion under Nepal's New Town Development Plan aimed at planned urbanization in middle hill regions. The project, initiated in FY 2010/11 and implemented from FY 2014/15, is managed by the New Town Project Office (NTPO), Baireni Galchhi Dhading.

Research Design and Approach:

This study adopts a case study methodology with a mixed-method approach, integrating both qualitative and quantitative data. The overall framework involves GIS-based mapping, survey analysis, and triangulation with secondary datasets.

Data Collection Methods:

Primary data was obtained through GPS-based field surveys, structured questionnaires using Likert scales, and key informant interviews involving planners, engineers, local officials and 98 registered landowners. Secondary data sources include cadastral maps, satellite imagery, project documentation, and municipal land pooling records.

GIS and Remote Sensing Tools Used:

GIS analysis was performed using ArcGIS 10.8. Satellite imagery from Google Earth and land use maps from the Land Revenue Office were used. Layers such as land use, roads, cadastral boundaries, and infrastructure networks were digitized.

Land Use Classification and Mapping:

Land use was classified into categories including agricultural, residential, market, school, barren land, shrubs/streams, and roads. Image preprocessing included georeferencing and raster-to-vector conversion. Accuracy was verified through ground truthing.

Assessment of Causes of Delay:
Delay factors were grouped into project-related, institutional, and socio-political categories. Structured interviews and coded thematic analysis of qualitative responses helped identify key parameters.

Impact Assessment of Land Pooling:
Impacts were measured through stakeholder perceptions, focusing on infrastructure development and land value change. A comparative analysis before and after pooling was carried out.

Data Analysis Techniques:
The Relative Importance Index (RII) was computed to rank delay causes. Spearman's Rank Correlation was used to assess consistency among stakeholder groups. Spatial overlay and buffer analysis were applied to land use maps.

Ethical
Ethical considerations included informed consent, voluntary participation, and confidentiality of respondent data. Local facilitators assisted in data collection to ensure clarity and cultural sensitivity.

To analyze delay causes and stakeholder perceptions, Relative Importance Index (RII) was computed using: (Sedgwick, 2014)

$$RII = \sum \frac{W}{A * N}$$

, where

W = weight assigned by each respondent

A = highest weight

N = total number of respondents

Spearman's Rank Correlation was also used to validate rankings from different stakeholder groups.

3. Results and Discussions

This section presents the key findings related to discrepancies in land coverage, causes of delay in the land pooling process, and the impacts of such delays on infrastructure development in the Galchhi LP project.

Discrepancy in Land Coverage
Using GIS mapping and cadastral data, the total land area of the pooling project was estimated at 460,539.62 sq.m (46.05 ha), whereas cadastral records indicated 452,771.4 sq.m (45.28 ha). The unregistered difference of 7,768.23 sq.m (0.77 ha) was found to be informally occupied by locals, often treated as private property. This unregistered land was distributed across agricultural use (0.36 ha), settlement (0.108 ha), and barren land (0.23 ha).

These findings are consistent with (Yomralioglu and Parker, 1993), who emphasized the ability of GIS to detect informal land use patterns and discrepancies in cadastral mapping. This affirms the reliability and necessity of GIS tools for resolving mismatches between digital and formal land records in semi-urban Nepalese settings.

This discrepancy highlights a major technical issue in land pooling processes where GIS reveals ground realities missed by outdated cadastral records.

Causes of Delay in the Land Pooling Process

Delays were assessed through structured questionnaires with 78 respondents. Five categories of causes were analyzed: project-related, users' committee-related, employer-related, consultant-related, and external factors. Top causes under each category based on RII index is tabulated below.

Table 1: Causes of delay in land pooling

S.N.	Categories of causes	Top causes	RII
1	Project-Related Causes	Inappropriate block plan	0.71
		Slow decision-making by TDC	0.71
		Inadequate penalties for delayed actions	0.69
2	Users' Committee-Related Causes	Political bias among committee members	0.85
		Lack of awareness among landowners	0.78
		Overlap of block plans with diverse land types	0.73
3	Employer-Related Causes	Frequent transfer of project managers	0.82
		Financial risks	0.69
		Delays in contractor selection	0.68
4	Consultant-Related Causes	Incomplete project reports	0.68
		Delayed submission of documents	0.66
5	External Causes	Political conflicts among landowners	0.83
		Difficult topography	0.75
		Lack of attention from TDC	

These results indicate that both governance-related inefficiencies and stakeholder-level conflicts are significant contributors to delays.

These results resonate with earlier findings by (Assaf and Al-Hejji, 2006) and (Edison and Singla, 2020) who cited poor site coordination, inconsistent leadership, and lack of stakeholder commitment as dominant delay factors in construction and land readjustment projects. The findings support the need for stronger institutional frameworks and accountability mechanisms in LP processes.

Impact of Delays on Infrastructure

Stakeholder responses revealed both positive and negative impacts of land pooling delays. While increased land value, infrastructure development, and regulated growth were among the positives, negative effects included increased land contributions, inflated construction costs, and longer implementation timelines.

This aligns with (Alaghbari, 2014) who observed similar impacts in Malaysian infrastructure

projects where delays disrupted budgets and undermined community confidence in planning systems. It also underscores the duality of LP outcomes when not executed efficiently.

Positive and negative impacts of land pooling were analyzed through RII-based responses. The following bar diagram depicts the results obtained from the study.

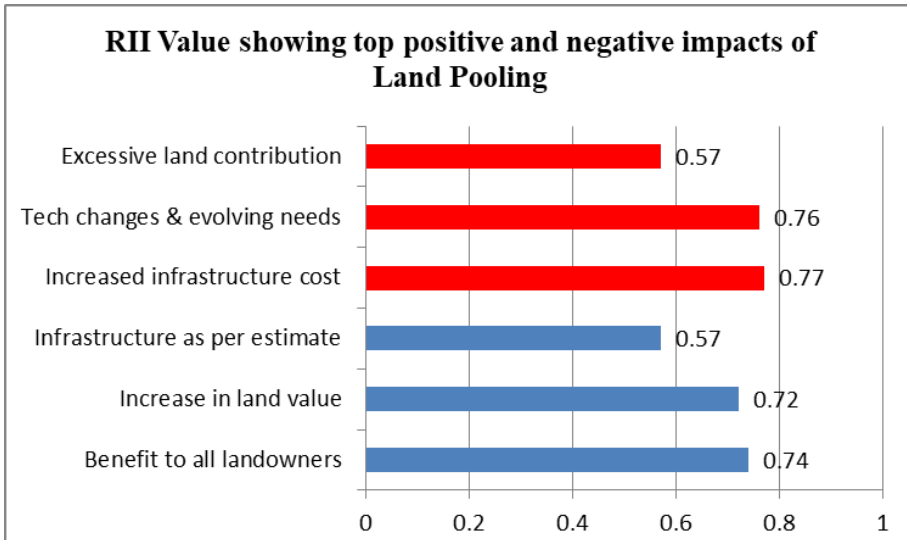

Figure 2: RII value showing top positive and negative impacts of land pooling

Reliability of Data

The Spearman's Rank Correlation Coefficient for various categories of delay causes ranged from 0.6 to 0.94, indicating moderate to high agreement among different stakeholder groups. According to (Sedgwick, 2014) such correlation coefficients signify strong internal consistency and enhance the reliability of stakeholder-driven field studies. The high correlation values in this study confirm that the identified delay factors are not isolated perceptions but broadly shared realities within the LP context. The causes of delay and corresponding Spearman's rank correlation coefficient are given below.

Table 2 Causes of delay and corresponding Spearman's Rank Correlation Coefficient

SN	Causes	Spearman's Rank Correlation
1	Project Related Causes	0.8
2	Users' Committee Related Causes	0.78
3	Employer Related Causes	0.94
4	External Causes	0.9
5	Consultant Related Causes	0.6
6	Positive Impacts	0.9
7	Negative impacts	0.9

4. Conclusions.

The Galchhi land pooling project offers critical insights into the technical and institutional complexities of implementing LP in hilly, peri-urban Nepal. This study identified a significant mismatch between cadastral records and GIS-derived land use data, revealing the crucial role of GIS in enhancing planning accuracy. Delays were found to stem primarily from project management inefficiencies, political interference, and stakeholder distrust, all of which erode the credibility and momentum of LP initiatives. While land pooling positively contributed to infrastructure development and land value appreciation, it also led to inflated costs and protracted timelines. Stronger legal enforcement, institutional consistency, and participatory governance mechanisms are essential to mitigate these challenges. Future LP projects must integrate updated digital land systems with ground-truthing processes and prioritize transparent stakeholder communication to realize their full potential in Nepal's urban transformation agenda.

5. Conflict of Interest

The author declares no conflict of interest.

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