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Adopting Geographic Information System (GIS) for Land Valuation for Infrastructure Development

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Abstract

In many developing countries, infrastructure development projects are not sustainable due to land valuation conflicts. Mostly, land valuers have assessed land value based on their experiences and without inference. They carry out the subjective land valuation. The detailed spatial analysis of the parcel is not considered for land valuation. The main objective of this study is to analyze the use of GIS in land valuation for land acquisition in infrastructure development. The study is carried out by a literature review with secondary data and primary data. The result shows that adopting GIS for land valuation is necessary and very important for establishing a realistic land valuation system. The model uses various criteria for weighted land valuation and follows an analytical hierarchical process.

Index terms— geographical information system, land acquisition, land valuation

1 Introduction

here is no official land valuation system in Nepal except Adhoc land valuation for compensation during land expropriation (Tuladhar, 2004) and is still the case in Nepal. The unfair procedure of land valuation and management, delayed payment of compensation, and inequitable compensation can reduce tenure security, harm public faith, and confidence in government and the rule of law. When this process is done poorly, it may leave affected people homeless, farmless, and jobless with a feeling that they suffered a grave injustice. Appeals against unfair procedure may delay the project and increase project costs that exceed the previously estimated costs (FAO, 2008). The land conflicts, such as low compensations, unfair compensations, etc. arise due to lack of reliable, consistent, transparent and efficient land valuation model for land acquisition in infrastructure development. The detailed spatial analysis of the parcel is not considered for land valuation. The current land valuation for land acquisition in developing countries, such as Nepal is done conventionally as given in Equation 1 and Equation 2, therefore, is not based on its objective analysis of geographical location. Vi=R*AREAi?????????????..?? (1) Value=?Vi???????????..?????? (2)

2 Objective

The objective of the study is to develop the land valuation model by adopting GIS. To support the main objective, the following sub-objectives are formulated as.

? To analyses the criteria affecting land valuation for land acquisition in infrastructure development ? To integrate the knowledge of GIS in land valuation for land acquisition in infrastructure development III.

3 Materials and Methods

The desk, and case study are followed for the research and desk study is followed by the scientific literature review in the field of geo-information science, and technology, land valuation and infrastructure development. The qualitative and quantitative research approaches were used to collect primary and secondary data in a case study area at Kathmandu Terai Fast Track Road Project in Makwanpur district, Chatiwan VDC of Nepal.

Household survey, key informants' interviews, focus group discussion and field observation were conducted to collect primary data while the relevant documents such as detailed project report, property valuation document and spatial data (cadastral data, image etc.) was also collected for the study. The formula given by Glenn (1992) is used for calculating a sample of the respondents for the household data collection because it is very simple to understand, and calculate the sample.

IV.

4 Study Area

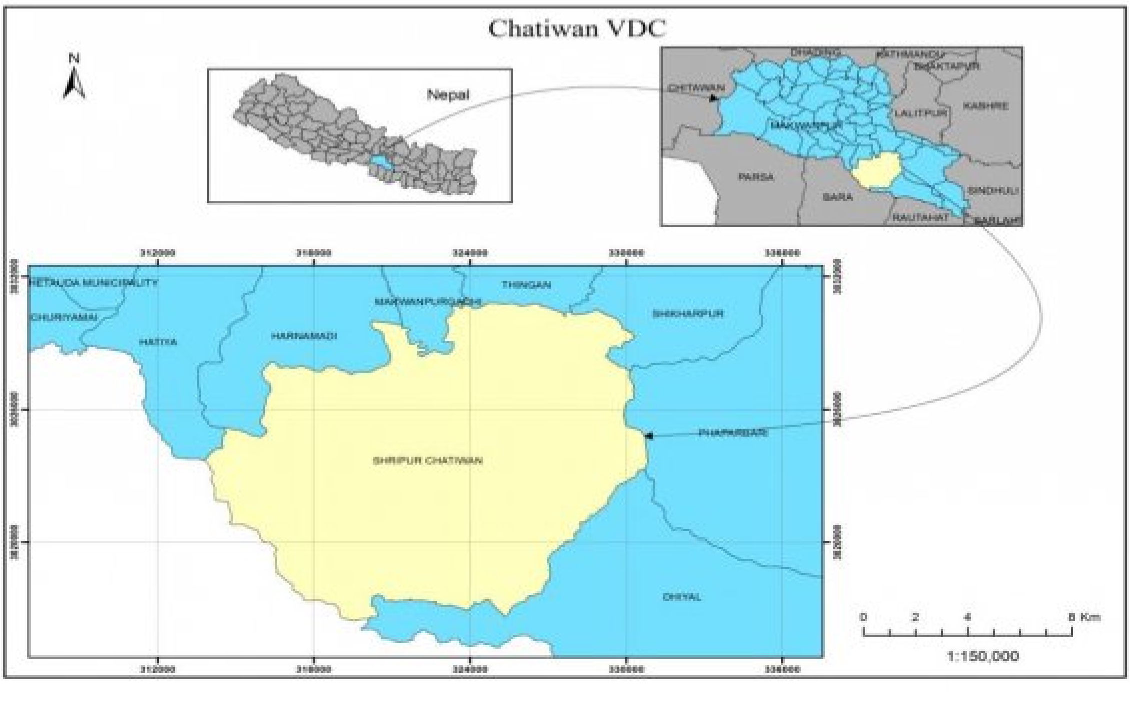
The location map of the case study area has been shown in Figure 1.

5 Results

The results are discussed in following subsections

6 Weight allocated based on Analytic Hierarchy Process

Analytic Hierarchy Process is an effective tool for dealing with the complex decisions by setting priorities and makes the best decision. According to Saaty (2008), it is a theory of measurement through pair wise comparisons and depends on the judgments of experts to find out a priority. Pair wise comparisons are based on forming judgments between two particular criteria rather than attempting to prioritize an entire list of criteria. Saaty (2008) has shown that weighting activities in multi-criteria decision-making can be effectively dealt with using the hierarchical structure and pair wise comparisons. An AHP aim is to obtain quantitative weights from qualitative statements on the relative performance of alternatives and the relative importance of criteria obtained from the comparison of all pairs of alternatives and criteria. As graduation scale for quantitative comparison of alternatives, the following numerical values are graduated as shown in Table 1. AHP is working with the matrix comparing each criteria to each other. The pair wise comparisons of different criteria by its importance carried out from the response of different stakeholders in Fast Track Road Project, Chattiwan VDC are mentioned in Table 2. The criteria are chosen based on (Yomralioglu & Nisanci, 2004), (Koirala et al, 2015) and from primary data collection. Similarly, the mathematical model for land valuation is: Global Journal of Researches in Engineering ( ) Volume Xx X Issue I V ersion I land valuation criteria and its weights to develop a land valuation model of land acquisition and compensation in infrastructure development. The input data are of different layers in a vector formats such as points, lines, or polygons. They are changed in raster format, and the criteria are used in the valuation process in proximity analysis. The AHP uses different combinations of criteria and weights to calculate for a combination for a weighted overlay of different criteria. [1] [2]



1

Figure 1: Figure 1 :

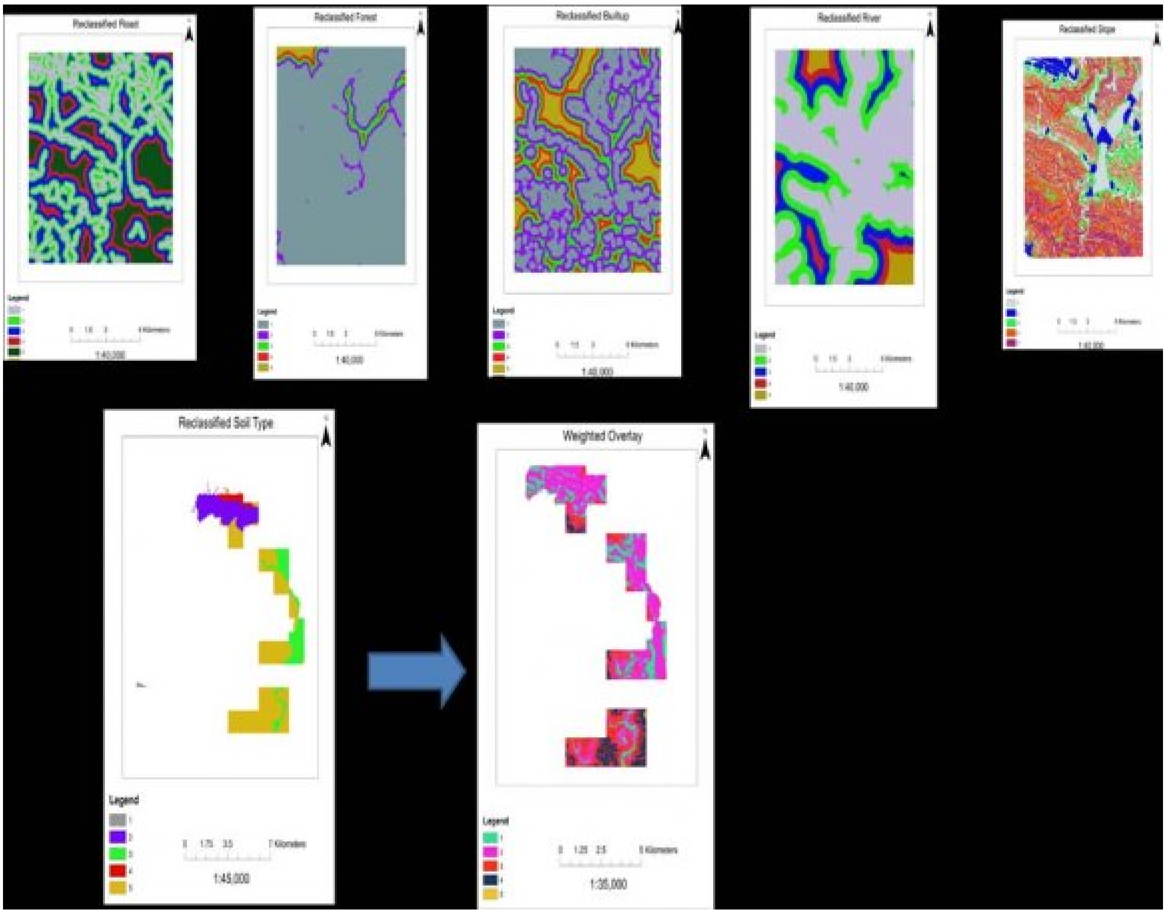

Reclassified Road
Reclassified Forest
Reclassified Builtup
Reclassified River
Reclassified Slope
Reclassified Soil Type
Legend
0 1.75 3.5 7 Kilometers
1:45,000
Weighted Overlay
Legend
0 1.25 2.5 5 Kilometers
1:35,000

Figure 2:

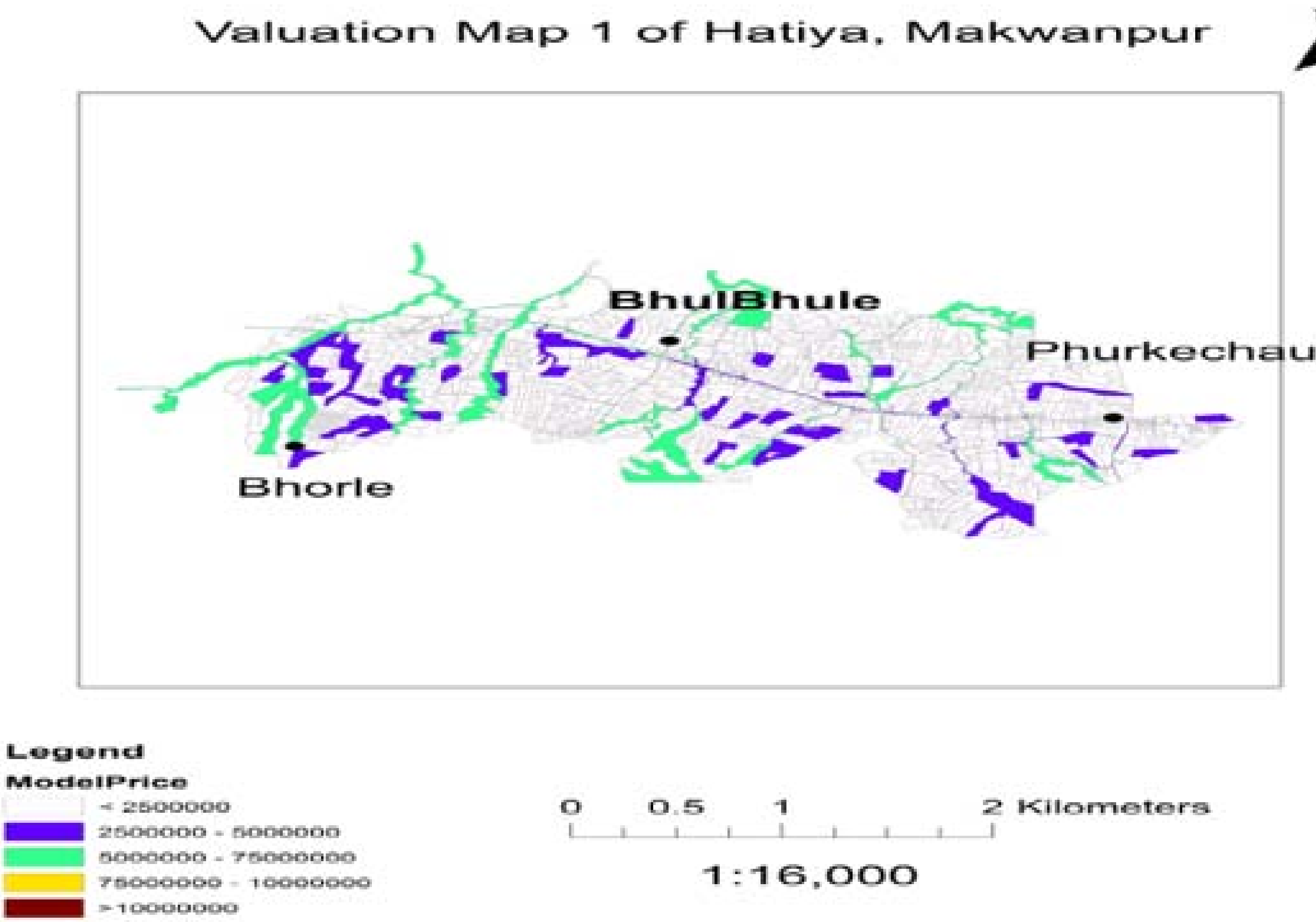


Figure 3:

1

Extremely less important	1/9
Very strongly less important	1/7
Strongly less important	1/5
Moderately less important	1/3
Equal important	1
Strong more important	3
Moderately more important	5
Very strongly more important	7
Extremely more important	9
Source: (Saaty, 2008)	

Figure 4: Table 1 :

2

Land valuation criteria	Road	Slope	Built up	Natural environments	Soil type	5th root of product	Eigen vector
Road	1	1	3	5	5	2.371	0.360
Slope	1	1	3	5	5	2.371	0.360
Built up	0.333	0.333	1	3	3	0.998	0.160
Natural environments (River and forest)	0.2	0.2	0.333	1	1	0.419	0.060
Soil type	0.2	0.2	0.333	1	1	0.419	0.060
SUM	2.733	2.733	7.666	15	15	6.578	1.000
SUM*PV	0.983	0.983	0.830	1.157	1.157	5.110	

Figure 5: Table 2 :

3

S. No.	Land valuation criteria and Eigen vector		Weightage calculated from AHP
1	Road	0.36	36%
3	Built up	0.16	16%
2	Slope	0.36	36%
4	Natural environments (River & forest)	0.06	6%
5	Soil type	0.06	6%

Figure 6: Table 3 :

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