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Rural Poverty Analysis: A case study of a district of Nepal

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Abstract

In the developing countries, decision makers face difficulty in allocating development resource at the local level due to the unavailability of an objective method that justifies the allocation. Poverty measurement methods, such as consumption based poverty measurement or Human Development Index could be used for the process, but those techniques are difficult to apply at the local level because of the constraint of resource. Therefore, a simple technique to categorize villages in terms of their development levels is always desired. This research is an attempt to address this problem. It has used socioeconomic and natural aspects to categorize villages in a district of Nepal. 24 variables are used to design five indexes - poverty index, social index, women empowerment index, infrastructure and institutional index and natural resources index. Correlation tests are applied to see the relationship between income data and indexes, and among the indexes themselves. The result shows a significant correlation between income and poverty index whereas no statistically significant correlation between income and other indexes. As expected, natural resources index shows significant correlation with other indexes. Based on the results, it can be asserted that income can be represented by an index prepared from certain variables in the rural context. Also the natural resources index can represent the development levels: the better the natural resources of a village the better the development. These variables and indexes help to compare the villages; when mapped in GIS, local planners and policy makers can understand the analytical results. This helps them to compare the level of development of their village to the district and national achievement which further helps them in bargaining resources with the concerned agencies.

Key words: Rural poverty, Poverty index, GIS mapping, Nepal, Kaski district

Introduction

The national plans of Nepal have been emphasizing the rural development to expedite the poverty reduction process in the country. This process requires more resource allocation in the poverty-stricken villages than the other villages. On one hand, the country has limited resources and on the other hand, it lacks an objective method to help planners and policy makers to allocate more resources to the neediest villages and justify the allocation. Technically, currently available poverty measurement methods or a measure of development could be applied to categorize villages, but the applicability of those methods at the local level is limited by a number of factors.

This paper devises a method that helps to categorize villages that helps further in the process of the allocation of resource. In short, the paper attempts to address the following issues:

(1) applicability of cross-country comparison methods, specifically the consumption based poverty measurement method and the human development index, that are popularly used for the comparison of poverty level and the development level respectively,

(2) possibility of using a proxy for income data in rural areas

(3) commonly used indexes in rural planning and their relationship with income and among themselves,

(4) interpretation of indexes using GIS maps

(5) management of database for rural planning

Background

Literature offers several poverty measurements methods, which were developed and modified overtime. Those methods are categorized in different ways. This paper accepts three categories of poverty measurement as suggested by Boltvinik (2002): non-normative, semi-normative and normative. The first step in all poverty measurement methods is to estimate a threshold called poverty line in order to identify the poor and non-poor population. The non-normative method uses a fraction of an income for the poverty line and considers people poor below that line. The EU countries use 50 percent of the mean value of each country's income for the poverty line for that country (Gustafsson, Zaidi and Franzen 2001). Under the semi-normative category, social and economic aspects are used as a basis for defining poverty. The rational behind this approach is that the increased income does not ensure the better quality of life of people (Morris 1979). The Physical Quality of Life Index (PQLI) and the Human Development Index (HDI) are examples in this category where cutoff of poor and non-poor is derived objectively. The normative method derives threshold on the basis of a notion of minimum living standard (Rowntree 1901; Fisher 1997; Rasanen et al. 2001; Zheng 2000). The process of poverty measurement started at the end of the 1800s and continued in a cyclic manner (Zheng 2000; Rusanen, Mailu, Colpaert, and Naukkarinen 2001).

The systematic work on poverty measurement and poverty line estimation can be seen in the works of Rowntree (1901) and Booth (2002). Their principle was

guided by the Engel's (1860) theory that states that the poorer the family, the greater the proportion of expense for food, other things being equal (Rowntree, 1901; Fisher 1997). In their work, they categorized the possible expenses of a household into three headings – food, shelter and other household sundry. Broadly speaking, they estimated the cost of food required for a family and then multiplied that cost by a factor of three to estimate the total poverty line. The process of policing poverty measurement method continued. In the United States, when the war on poverty was declared in 1964, it used the then available poverty line developed by Orshansky (1962). Orshansky derived different poverty lines from five different food packages – liberal, moderate, economy and two low cost food plans. The government picked up the one with the economy food plan out of those five packages (Orshanski, 1962; Fisher 1997). The economy food plan included quantities of food to provide a good diet for a cost lower than the other plan. Orshansky estimated the cost for food and used a multiplier of 3 to account for the shelter and other household requirements and estimated the total poverty line. Poverty lines were compared with the income of an individual or a family. Individuals or families having income below their corresponding poverty line qualified for the designed government subsidies. A number of revisions have been made in Orshansky's method over time. So far the applicability of this approach in the developing countries is concerned one can easily predict that it is not applicable in the developing countries as those countries lack income data at the household or individual level. Therefore, the World Bank (WB) developed a method – the Household Living Standard Survey (HLSS) in 1985 (WB 2006), which uses most of the fundamentals of the method as described. This survey

is based on a sample survey where the sample size varies from 1600 to 3200 households for a country. The survey collects data for both consumption and the poverty line together and determines the percentage of poor and non-poor (WB 2000; Lanjow 2000). To apply this method at the local level, a household or village, a country requires huge amount of resource – human, financial and time – which is limited in the developing countries.

The Human Development Index (HDI) comprises of three indicators: (1) life expectancy at birth, as an index of population health and longevity, (2) knowledge and education, as measured by the adult literacy rate and the combined primary, secondary, and tertiary gross enrollment ratio, and (3) the standard of living, as measured by the natural logarithm of gross domestic per capita (GDP) at purchasing power parity (PPP) in USD. Another popularly used index – the Human Poverty Index (HPI) was introduced in the human development report in 1997, which assesses the same three components from the opposite point of view to take into account factors that HDI does not include. Applicability of these methods is also limited in Nepal. Data for these indicators are only available at the regional or national levels; those data are not collected or disaggregated for the local level. On the other hand, rural poverty is multifaceted and needs several measures to reduce it. Accordingly, several development agencies have been working in the rural areas with specific objective(s) and they need information on the status of indicators related to their objectives; three indicators used in this method would not reflect the requirement of those agencies.

Resource flows in the villages through both the government and the non-government agencies. Most of the time these agencies work for a particular objective(s) depending upon the availability of resource. These objectives can be of several types, which can vary from simple, such as improving literacy of women or providing clean drinking water to the specific population segment, to broader one, such as public awareness program, or overall poverty reduction program. The planning bodies have to assign geographic area(s) or a segment of population that is appropriate for the respective agency. The planning body at the local level – the District Development Committee (DDC) – in Nepal primarily consists of elected personnel from the political parties. Their decision can be biased. First, they tend to allocate the available resource to their preferred areas. Or in many cases, due to the absence of data they follow a participatory approach, which might not necessarily send resource to the right place. In both cases, the neediest people can be missed out (Dechmann 2000). Therefore, a method that helps to categorize villages is desired, which subsequently helps decision-making body in the resource allocation process. In an attempt, the International Center for Integrated Mountain Development (ICIMOD) had mapped several indicators and indexes for the districts of Nepal. The result was useful to compare districts of Nepal in terms of development level. Furthermore, a district as a planning body has responsibility of planning available resources efficiently in its villages. The planning process is more complicated at this level as planers and policy makers are directly dealing with the real beneficiaries. Keeping this fact in mind, this research is focused for the district level planning.

A district called Kaski in Nepal was selected for this research. Variables and indexes were selected and finalized through the consultation with planners and policy makers at the local as well as at the national level. Table 1 shows the selected indexes, respective variables, their significance to poverty and citations, if any. The variables in the table are of two types. First type of variables is inversely proportional to poverty i.e. poverty decreases if the variable value increases. They are denoted by a suffix X. Second type of variables are directly proportional to poverty i.e. poverty increases if the variable value increases. These variables are denoted by a suffix Y. The analysis comprises of four parts: (1) correlation test between income data and indexes (2) correlation test among indexes, (3) correlation test between selected variables and indexes, and (4) mapping of indexes and variables in GIS. As pointed out by Morris (1979) no theory works in defining the physical quality of life of people. I relied more on practices in the field and advices of planners and policy makers in adopting indexes rather than seeking theories in literature.

Insert table 1

METHOD

Study area

Nepal is predominantly a rural country. The Central Bureau of Statistics (CBS) survey of 2001 showed that almost 85 percent population resides in the rural areas. The concentration of poor in the rural areas is 44 percent in comparison to 23 percent in the urban areas. The HDI 2007 places Nepal in 142nd place among 177

countries, the 1st being the best. The country is small by area, but has a vast geographic variation as the altitude varies from 76 meter to 8,848 meter over the north-south span of approximately 200 Kilometer. Therefore, Nepal is divided into three ecological regions – Terai (the plain area), Mountain and Himalaya regions and also 75 districts.

Kaski district, the study district, is located in the western part of Nepal. Within a small area of 2,017 square kilometer, its altitude varies from 450 meter to 8,100 meter from the mean sea level (DISCO 1995). Consequently, the ecological variation is high in the district. It has 43 Village Development Committees (VDC) which are the smallest administrative units, one municipality and one sub-municipality. In an average, the area of a VDC is 45 square kilometer where, according to the decadal census of 2000, population varies from 1,044 to 9597. In this research VDC and village will be used interchangeably. Figure 1 shows the map of the district with its VDCs and municipalities.

Insert Figure 1 here

The United Nations Development Program's (UNDP) Participatory District Development Program (PDDP) worked in this district to facilitate planning process for a long time. Therefore, the district has relatively better data status, both in terms of quality and quantity, than other districts in the region.

Data and data analysis

Required data were not available from a single source, though I expected that the DDC as a district planning body would pose all development related data and natural resources data for the district. The demographic data used in this research were from the decadal census of 2000. The other socioeconomic data were also collected in 2001. Thus the problem of data mismatch was attempted to minimized (Knodel 1997).

Demographic and development related data were available partly in the DDC and partly in its line agencies. Digital map of the district with VDCs boundaries was available in the National Planning Commission (NPC) in the capital. Natural resources related data was also available in the NPC. This data was digitized by the Land Resource Mapping Project (LRMP) and was available in Geographic Information Systems (GIS) format. I process those data for the selected variables for VDCs using ArcView 3.2. Some demographic data, such as caste was available in the CBS. Though the discrimination against caste is prohibited by the constitution of Nepal, it still speaks a lot about poverty in the country (Chettri 1996; IFAD 2006). The DDC had income data for the household level. It was collected by the DDC for each household and aggregated for the VDCs. All these data, demographic, natural resources and socioeconomic, were used by researchers, planners and policy makers at the district level as well as at the national level. Therefore, without questioning their reliability, this research used those data.

Variable values were standardized using zero to one scoring transformation (UN 2000). In the first type of variables with suffix X, higher values of a variable signify the better condition of a village in terms of that variable. Therefore, the

highest values were transformed to 1 whereas the lowest values were transformed to 0. The values between the highest and lowest were transformed accordingly. In the second type of variable with suffix Y, lower values of a variable signify the better condition of a village in terms of that variable. Therefore, the lowest value of each variable is transformed to 1 whereas the highest values were transformed to 0. The higher transformed values now give the wellbeing of the villages. The poverty is opposite of wellbeing. Therefore, four variables under poverty index were computed in an opposite way than as described above. Equation 1 and equation 2 transformed values of first and second type respectively.

Transformed Value (x)

$$= \frac{Xij - Xi(\min)}{Xi(\max) - Xi(\min)} \qquad \text{Equation 1}$$

Xij is a selected value of a variable whereas $Xi(\min)$ and $Xi(\max)$ are minimum and maximum value of the same variable.

Transformed Value (y)

$$= \frac{Xi(\max) - Xij}{Xi(\max) - Xi(\min)} \qquad \text{Equation 2}$$

Indexes are computed from the transformed values of variables. All variables were treated equally important and assigned an equal weight of 1. It is partly because of the absence of different weights for different variables Therefore, the composite index is simply an average value of the respective variables grouped under that index.

Result and discussion

Simple correlation analysis helped to draw some important results. Among them, the first was the correlation between income and indexes (Table 2). The objective of this research was to design a proxy for income referred to as poverty index. The poverty index is designed with four variables: (1) household farm size, (2) percentage of thatched roof houses, (3) percentage of households with food deficiency from three to nine months, and (4) percentage of scheduled caste population. Test showed that income had a negative correlation with poverty index. Based on this result, it can be asserted that income could be represented by the designed poverty index in this particular district. This district is a typical mid-hill district and can represent the mid-hill districts of Nepal. The country is diverse not in ecological aspect but also in the cultural aspect. The schedule caste can vary in different regions. The same caste used in this research might not work for three ecological regions, and need to be chosen the right one carefully. The relationship between the income and the poverty index is not very strong. The reason can be the accuracy of the available income data. There is a room for questioning the accuracy of the available income data. As the World Bank (2000) suggested, collecting data and information for income is difficult because people do not like to disclose their assets and income. At the same time, it is hard for informants to recall the income of the entire year at the time of survey as their income is based on agriculture; they do not maintain records.

Insert Table 2 here

Second, income did not show statistically significant correlation with other indexes. The result is a proof of the assumption made in the semi-normative category of poverty that income cannot represent the quality of life of people, which is true in the case of rural areas.

Third, the natural resources index had statistically significant correlation with SDI, III and WEI (Table 3). This was an expected result since the rural life is closely tied with the natural resources. The natural resources index has a strong correlation (0.640) with III, which signifies that the villages with better natural resources had tapped more development resources.

Insert table 3 here

Some of the variables showed statistically significant correlation with many of the other variables. Among them were (1) road distance from the village center, (2) percentage of area having slope greater than 30 degree, and (3) population density. These variables were frequently tested by researchers to see their role in rural development (Shrestha 2002). I tested these variables with indexes other than those where they were included. First, the road distance from the VDC center has significant correlation with the NRI and the WEI and the correlation is negative. Villages closer to the road have better natural resources and also women are better empowered. Second, the percentage of area having slope greater than 30 degree had negative correlation with the III. This signifies that geographically difficult villages

could attract less resource for infrastructure development. Third, the population density showed statistically significant correlation with SDI, III and WEI. Population is considered as a threshold for allocating resource: more resource goes to the highly populated villages (Routray 2000). Second and third result i.e. the negative relationship between the population density and percentage of area having greater than 30 degree help to conclude that less resource went to the less populated area which also had difficult terrain. Table 4 and Table 5 show the correlation coefficient of the variables and indexes.

Insert table 4 here

Insert table 5 here

These variables and indexes are helpful to compare the development level of the villages not only within one district, but also for the whole country. The cutoff can be fixed for each variable or index based on the objective of the country in order to identify the villages deprived in terms of that particular aspect. This categorization further helps planners and policy makers for resource targeting both at the national level and district level.

Mere statistical data or numerical values are less helpful for planners specifically at the local level. Maps have proven helpful to enhance the understanding of the data and analytical results. Geographic Information Systems (GIS) is instrumental in this process. I generated a series of maps in GIS: (1) overall composite index map including all 24 variables, (2) index maps, and (3) variable maps. For the demonstration, I have presented three maps (1) overall index map, (2)

women empowerment index map, and (3) literacy map. The villages are grouped into four categories using quartile method in GIS – very poor, poor, fair and good. The overall index map shows that villages closer to the district center are better off. In the map, areas with no symbol are the municipalities; the inner one includes the district center. It is apparent in the map that the farther the village from the district center, the lesser the development level. Most of villages located in the northwest and southeast corner of the district are in the very poor category. Similarly, villages can be compared for the women empowerment level and literacy level in the respective maps. It takes no time to compare villages in terms of a particulate variable or index in the map even if one does not have any knowledge of statistics or numbers.

Insert Figure 2, 3 and 4 here

This simple looking process requires accurate data. For the research, I designed almost double variables of what I could use in this research because of unavailability of data. Available data were scattered in different agencies some at the district level and some at the national level. As a planning body, general expectation is that a district should be equipped with natural, socioeconomic and demographic data. In the DDC planning meeting, which takes place every year, all district line agencies submit their data and progress report to the DDC. Some districts are equipped with computer and able to store those data. But most of the districts do not have access to those equipments and also human resources who can handle them.

Therefore, a body at the national level apparently has to play the role of database management.

The NPC could be a potential body for data collection and storage. Every year when the DDC planning meeting gets completed, the data submitted by the concerned agencies can be collected in the NPC and entered into the database. For demographic and some of the socioeconomic data, Nepal can implement the experience of the developed countries where decennial census data are managed in the website and made available for all. Nepal has around 4,000 villages where this task should not be very complicated. Once the data are compiled, maps can be prepared. These maps could be sent to the respective districts for their use. On one hand, at the planning level, this process helps to plan resource and also monitor the progress over time. On the other hand, presentation of data in the form of map enhances awareness of beneficiaries at the local level about (1) the current development status of their village in comparison to the district and national achievement, (2) the target of the national and international organizations, (3) bargaining resource with the concerned agencies, (4) working towards the targeted goals. The truth is that at the national and international level planners and policy makers have been working very seriously to improve the quality of life of people in the rural areas of the developing countries where the people do not know where they stand in terms of poverty. If they know, they would just blame their fate for their situation.

Finally, the Eighth (1992-1997) and Ninth National Plan (1997-2002) of Nepal emphasized in the development of a simple method that helps to identify

poverty-stricken areas for the purpose of effective resource targeting. I expect that this research paper would be helpful to that end.

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Table

Table 1: Indexes, variables and citations

Index	Variable	Citation(s)
Income	Annual average per capita income (X_1)	Lanjow 2000; Minot 2000; WB 2000; Zheng 2000
Poverty index (PI)	Household farm size in ha. (X_2)	Sharma 1997; ICIMOD 1997; IFAD 2006
	Percentage of thatched roof house (Y_1)	Sharma 1997; ICIMOD 1997
	Percentage of households with food deficiency from 3 to 9 months (Y_2)	Routray 1997; Sharma 1997; ICIMOD 1997
	Percentage of schedule caste population (Y_3)	Chettri 1996; ICIMOD 1997; IFAD 2006
Women empowerment index (WEI)	Percentage of female workers in nonagricultural occupation (X_3)	NHDR 1998; Routray 2000; WB 2000
	Percentage of females illiterate (Y_4)	ADB 1993; ICIMOD 1997; UN 2000; WB 2000
	Percentage of girls in primary education (X_4)	NHDR 1998; ICIMOD 1997; WB 2000
Social development index (SI)	Percentage of overall literacy (X_5)	Routray 2000; NHDR 1998; WB 2000
	Percentage of populations having access to clean drinking water (X_6)	Sullivan et al. 2003; UN 2000; WB 2000
	Percentage of household having electricity (X_7)	ICIMOD 1997; UN 2000
	Percentage of population employed from secondary and tertiary sectors (X_8)	UN 2000; WB 2000
Infrastructure and institution index (III)	Percentage of irrigated agriculture area (X_9)	WB 2000; Minot 2000
	Road density (all types of motor-able road) (X_{10})	ICIMOD 1997; Routray 2000; Shrestha 2002
	Number of banking units per 1000 people (X_{11})	ICIMOD 1997; Minot 2000
	Road-head distance from VDC center in hours (Y_5)	ICIMOD 1997; Routray 2000
	Number of Cooperatives per 1000 people (X_{12})	ICIMOD 1997; Routray 2000
	Number of agriculture service centers per 1000 people (X_{13})	ICIMOD 1997; Routray 2000

Natural resources index (NRI)	Percentage of cultivated area (X_{14})	ICIMOD 1997; Sharma 1994
	Percentage of forest area (X_{15})	ICIMOD 1997
	Percentage of grass land area (X_{16})	ICIMOD 1997
	Rural population density (X_{17})	ICIMOD 1997; Routray 2000
	Percentage of area with slope greater than 30 degree (Y_6)	DSC, Nepal 1995

Table 2: Correlation between income and indexes

	PI	NRI	SDI	III	WEI
Average per capita income per annum	- 0.332*	-0.093	0.190	-0.081	0.139

* Level of significance = 0.01(2-tailed).

Table 3: Correlation between indexes

	PI	NRI	SDI	III	WEI
PI	1.000	-0.131	-0.091	-0.067	-0.014
NRI	-0.131	1.000	0.424*	0.640*	0.224*
SDI	-0.091	0.424*	1.000	0.238	0.552*
III	-0.067	0.640*	0.238	1.000	-0.130
WEI	-0.014	0.224*	0.552*	-0.130	1.000

* Level of significant = 0.01 (2-tailed).

Table 4: Correlation between road distance and indexes

	PI	NRI	SDI	WEI
Road distance from the VDC center (hr)	0.077	-0.516*	-0.290*	-0.218*

* Level of significance = 0.01 (2-tailed)

Table 5. Correlation between selected variables and indexes

	PI	SDI	III	WEI	% of area having slope > 30 degree
% of area having slope > 30 degree	0.090	-0.240	-0.476*	-0.113	1.000
Population density per Km^2	-0.126	0.417*	0.638*	0.243*	-0.457*

* Level of significance = 0.01 (2-tailed)

Figures

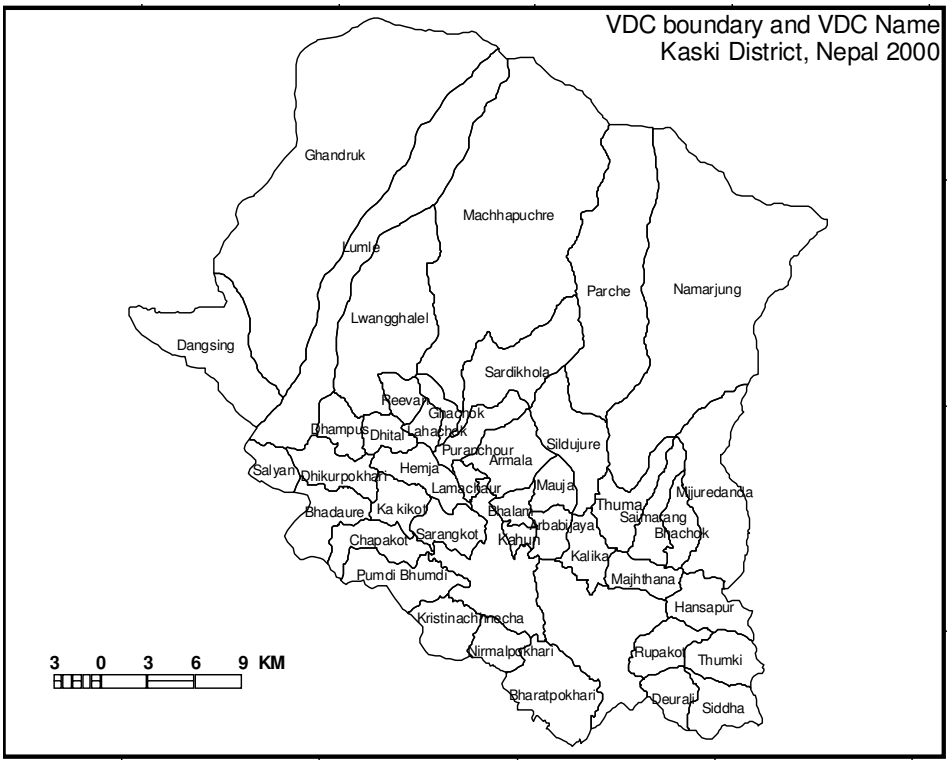

Figure 1. Kaski district with villages and municipalities.

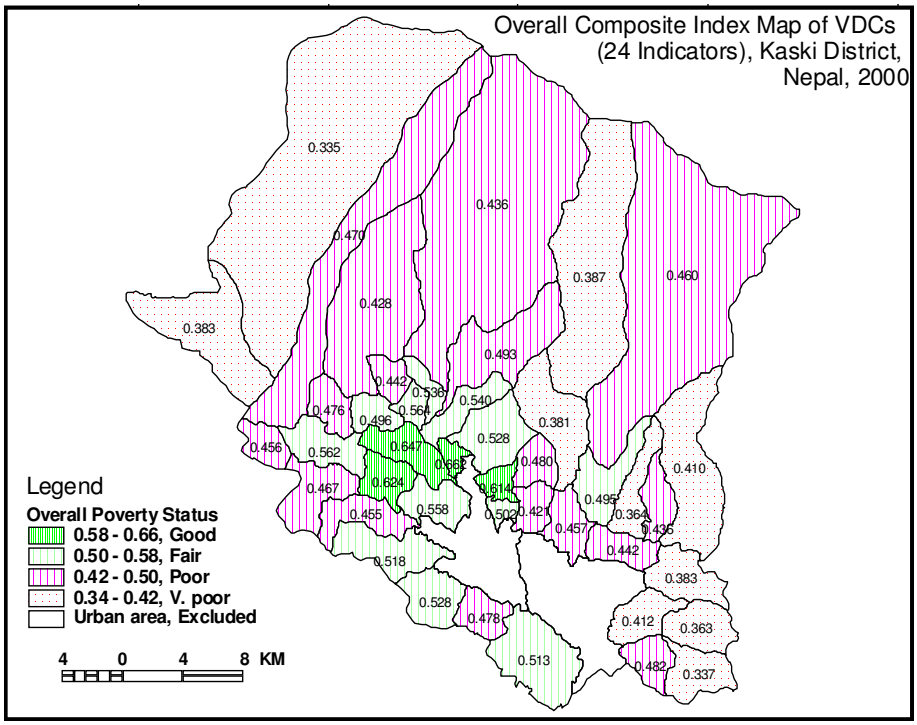

Figure 2. Overall Index map.

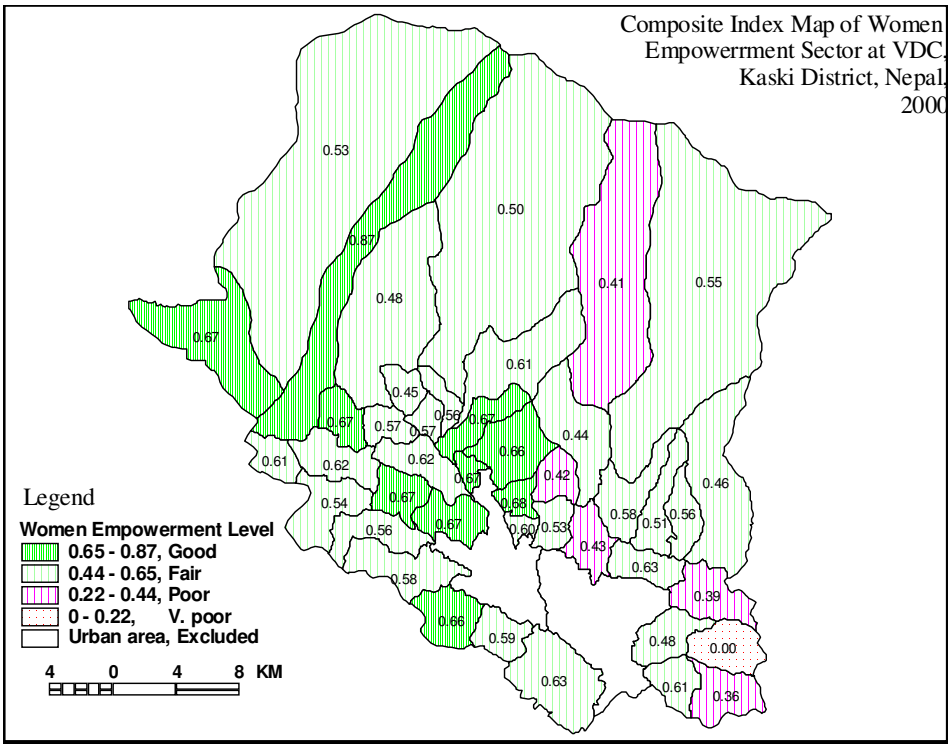

Figure 3. Women Empowerment Index.

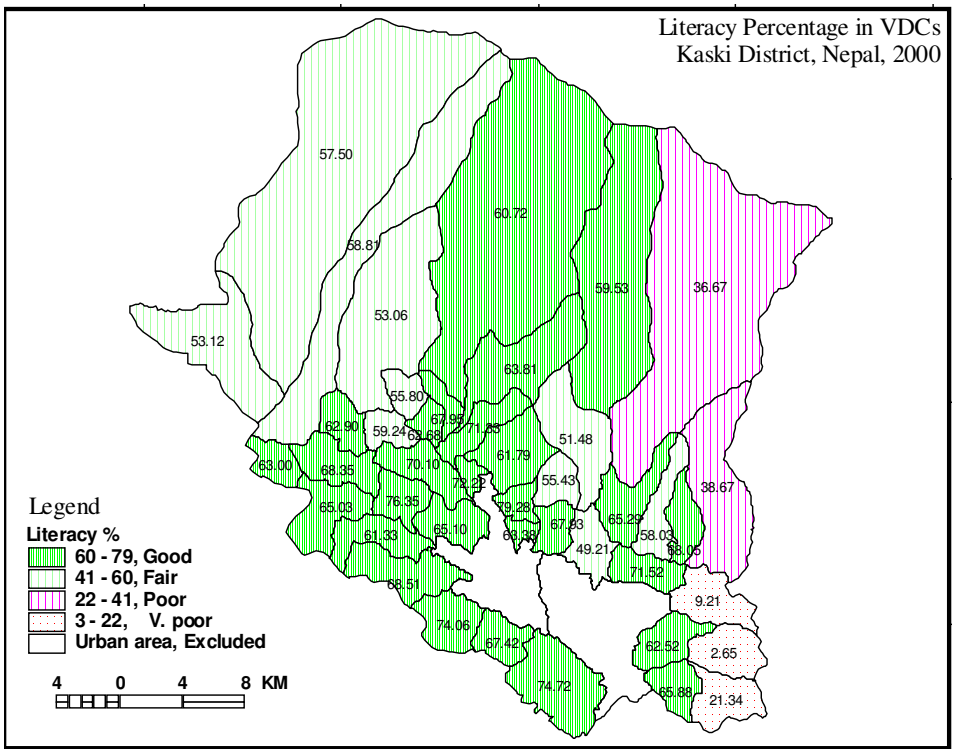

Figure 4. Literacy map.