Mapping Regional Disparities in Socio-economic Dynamics in the Mountain Environs of Ladakh, India

Mushtaq Ahmad Kumar[1*], G. M. Rather[1] and Aijaz Ahmad Khanday [1]

[1] Department of Geography and Disaster Management, University of Kashmir, Srinagar.

ABSTRACT

Ladakh over the years has significantly changed owing to the changing socio-spatial patterns in the levels of development. The region interspersed with many geo-environmental and locational factors, the socio-economic dynamics of the area is thus influenced by the same considerations. As Ladakh balances economic growth, cultural preservation, and environmental sustainability, this research establishes a foundational framework for interpreting regional dynamics. Utilizing the Weighted Sum Method (WSM) with a scale of 0-1 following an extensive field survey and secondary source analysis, we classified the socioeconomic status into high (0.584-0.717), medium (0.450-0.583), and low (0.316-0.449) categories. The findings reveal that Leh block and Skurbuchan block represent the two extremes with values of 0.717 and 0.316, suggesting the initial advantage of the region influencing the socio-economic development of these blocks. This research deals with the comprehensive exploration of the mountainous environs of Ladakh, unravelling the complexities of its socioeconomic landscape through a rigorous analysis of demographic, housing, health, and educational parameters. It offers critical insights to devise strategies for elevating socioeconomic status, contributing to sustainable development initiatives. The findings propose for robust policy measures to be implemented from governmental and non-governmental stakeholders for fostering a more equitable and prosperous socio-economic development of the region as whole.

Keywords: *Socio-economic, Regional disparity, Ladakh, Mountain environs*

INTRODUCTION

Socioeconomic indicators serve as pivotal tools in facilitating a comprehensive understanding of the intricate interplay between economic dynamics and societal structures within communities, regions, and nations (Liu *et al.,* 2015). These indicators, comprising a blend of quantitative and qualitative measures, are instrumental in providing valuable insights into a society's overall well-being, economic activities, and resource allocation (King *et al.,* 2014). Their significance is underscored by their role in enabling policymakers, researchers, and stakeholders to make informed decisions, formulate effective policies, and devise strategies aimed at fostering sustainable growth, ameliorating disparities, and enhancing the quality of life for all members of society (Mahroum, 2012; Lee *et al.,* 2003). They fulfil the vital role of assessing, summarizing, and communicating complex societal issues and patterns (Iribarren *et al.,* 2016). By dissecting multifaceted concepts related to sustainable development, socioeconomic indicators facilitate a deeper comprehension of the fundamental issues and their interconnections and empower individuals to comprehend the requisite actions to contribute to overarching societal goals (Streimikiene, 2015).

The domains encompassed by these indicators are vast (Gottfried *et al.,* 2014), covering pivotal aspects such as income distribution, educational opportunities, healthcare accessibility and quality, employment prospects, housing conditions, and access to essential services. Through a comprehensive exploration of these domains, socioeconomic indicators illuminate the living standards and economic circumstances of a population (Laaksonen *et al.,* 2005), providing a detailed portrait of their daily lives and overall societal development.

Income distribution, for instance, pertains to the equitable allocation of a society's total income among its residents or households, thereby reflecting income inequality (Reardon & Bischoff, 2011; Baulch & Hoddinott, 2000). Understanding and addressing income distribution is pivotal in the realm of social and economic policy-making, bearing implications for social cohesion and overall societal well-being (Duhaime *et al.,* 2004; Blanchard & Rodrik, 2023; Atkinson & Brandolini, 2001).

The access to and quality of healthcare services are integral cornerstones of a well-functioning healthcare system (Hunt & Backman, 2008). Access, in this context, signifies the ability of individuals to obtain essential healthcare services, considering factors such as geographic location, financial accessibility, and equitable availability (Neutens, 2015; Zineldin, 2006; Andrulis, 1998; Murray & Frenk, 2000; Pincus *et al.,* 1998).

Educational opportunities encompass a diverse array of resources available to individuals for learning and skill development (Allen et al., 2012). Access to educational institutions and programs constitutes a critical aspect, and the principle of equity and inclusion ensures that individuals, regardless of their background or circumstances, have equal access (LazÄfr, 2020). Quality teaching, early education, vocational training, higher education, and lifelong learning are all crucial components of skill development (Chitiba, 2012). Enhancing educational opportunities is pivotal not only for personal development but also for fostering social mobility, spurring economic development, and propelling societal progress (Nishimura & Yokote, 2020). By enhancing access, equity, and the quality of education, individuals are empowered to realize their full potential and contribute to their communities and the broader

global landscape (Tikly & Barrett, 2011; Thompson & Thompson, 2018; Kyriakides *et al.,* 2020).

Housing, in its fundamental capacity, pertains to the provision of living spaces and accommodations, which are essential for shelter, security, and community well-being (Bryant, 2004). This encompassing concept entails various dimensions, including the types of structures, ownership arrangements, affordability, quality, and considerations regarding geographical location (Aurand, 2010; Anderson, 2012; Wang & Murie, 2011).

Assessing the extent of socioeconomic status necessitates the specification and quantification of fundamental factors (Wilkinson & Pickett, 2007; Norman, 2010; Lawrie *et al.,*2011; Tay & Diener, 2011). Consequently, a set of quantitative indicators representing the core determinants of development must be identified to gauge the overall progress of regional systems (Meadows, 1998; Pampalon & Raymond, 2000; Packness *et al.,* 2019; O'Neill *et al.,* 2014). In this context, the assignment of weights to these indicators assumes a pivotal role, and conducting sensitivity analyses of these weights presents a viable solution. The weighted sum method, widely employed, provides a robust framework for the assessment and appraisal of these indicators, enhancing the overall efficacy of the evaluation process (Pursky *et al.,* 2019).

The global socioeconomic landscape constitutes a multifaceted domain, influenced by a myriad of variables (Williams *et al.,* 2010). The imperative of global coordination in addressing health and economic crises was underscored by the COVID-19 pandemic (Ros *et al.,* 2021; Thomas, 2012). Within this intricate global socioeconomic context, the ongoing endeavours to achieve

sustainability, equity, and economic stability remain fundamental objectives.

Within the framework of the Indian socioeconomic landscape, a multifaceted and dynamically evolving scenario emerges shaped by a confluence of economic, social, and political factors (Bharath *et al.,* 2018). India's remarkable economic growth, primarily driven by key sectors such as agriculture, industry, and services, has propelled it to the ranks of the world's largest and swiftly advancing economies (Dholakia, 2002; Kotwal *et al.,* 2011). India has made commendable progress in broadening access to education and healthcare services (Joumard & Kumar, 2015; Hill & Chalaux, 2011); however, apprehensions about the quality and inclusivity of these services, particularly in rural regions, persist. Poverty alleviation initiatives, particularly through social welfare programs, continue to be central to the national development agenda.

In Ladakh, a region characterized by its unique topography and rich cultural heritage (Hussain *et al.,* 2023), economic expansion is propelled by the pivotal sectors of agriculture, tourism, and traditional craftsmanship. However, persistent economic disparities persist between urban and rural communities. (Sood, 2000; Debarbieux *et al.,* 2014). Agriculture faces limitations, including scarce arable land, and remote communities encounter challenges regarding access to education and healthcare services (Sherratt, 2014). Poverty alleviation programs are in place, and the increasing trend of urbanization has implications for housing and infrastructure development (Le Masson, 2015). Ladakh's pristine ecosystem necessitates conservation measures, even as efforts in digital connectivity and infrastructural development are underway (Lama & Sattar; Kapoor, 2021). International relations,

particularly in border areas, play a significant role. In this unique Himalayan region, government initiatives are dedicated to striking a balance between economic growth, cultural preservation, and environmental sustainability (Cyr, 2018).

In the context of Ladakh's evolving socioeconomic landscape, particularly considering its distinctive characteristics, this research examined the socioeconomic parameters which provide critical insights into the overall development of the study area. Our research asserts that the conventional focus on socioeconomic indicators has implications for the overall well-being of the community. The research intends that a balanced and inclusive approach to assessing and enhancing Socio-Economic Status (SES) is crucial for the prosperity of Ladakh's communities. Furthermore, this in-depth analysis not only sheds light on the existing socioeconomic landscape but also provides a blueprint for understanding its dynamics and charting a course towards well balanced and meaningful socioeconomic development in the region.

MATERIALS AND METHODS
Study area

The Union Territory of Ladakh (figure 1), characterized by its mountainous terrain and cold desert environment, is situated amidst the Zanskar, Ladakh, and Karakoram Mountain ranges (Ghosh *et al.,* 2020). Its geographical boundaries encompass the north and east, bordering Tibet (China), the northwest, adjoining Gilgit and Skardo (Pakistan), and to the west, sharing borders with the districts of Baramulla, Srinagar, Anantnag, and Doda. The region lies between 32^0 N - 37^0 N Latitude and 74^0, 30' - 80^0,30' E Longitude (Taqi, 2020) and spans an extensive area of approximately 96,701 square kilometres

(Angmo *et al.,* 2022), which includes territories occupied by China and Pakistan (Singh, 1992; Sagwal, 1991). Ladakh stands as one of the world's highest-altitude regions (Bharti, 2022). Comprising two districts, Leh and Kargil, and incorporating 25 administrative blocks, the Union Territory exhibits distinctive demographic characteristics. It accommodates a total of 40,247 households and a population of 274,289

individuals (Haq *et al.,* 2020). Notably, Ladakh boasts one of the lowest population densities in India, with an average of merely 4.6 individuals per square kilometre. Within the Union Territory (Kimura, 2014), Leh reports a population density of 3 persons per square kilometre (Anees *et al.,* 2022), while Kargil records a somewhat higher density of 10 persons per square kilometre (Hussain *et al.,* 2023).
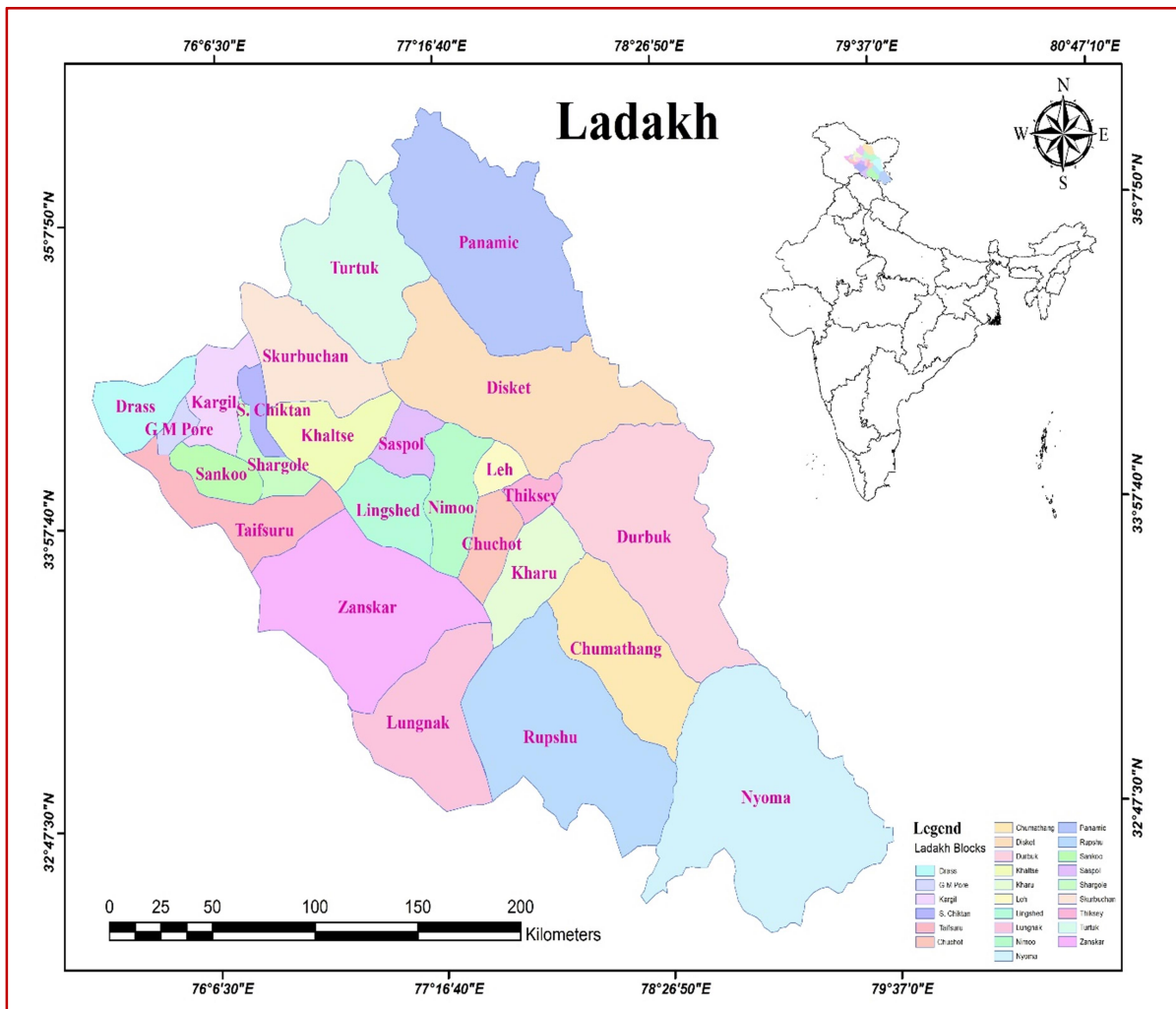

Fig. 1. Location map of study area.

Study design and sample size

A comprehensive household survey was undertaken across all 25 Blocks within the Ladakh Union Territory. Data collection occurred during

the period spanning from June to August 2019. The selection of households for this research was carried out through a random sampling methodology. A total of 784 households were

included in the survey, and the sample size allocation was determined proportionally based on the total number of households within each administrative block, following Solvin's population proportion formula (Slovin, 1960; Stephanie, 2003).

$$n = \frac{N}{1 + Ne^2}$$

where, n = sample size, N = total population and e = margin of error

Data collection was carried out using a structured questionnaire designed to capture a wide range of variables. These variables encompassed critical aspects such as Age, Gender, Occupation, Yearly Income, Sex Ratio, House Type, House Ownership, Education, and Occupational Status. The evaluation of socioeconomic characteristics included an assessment of household conditions, sources of drinking water, sanitation facilities, and the availability of electricity, among others. This comprehensive list comprised 33 variables, categorized into four overarching parameters: Demography, Housing, Health, and Education for computing the regional disparities at the block level in the study area.

METHODOLOGY

Weighted Sum Method (WSM) which has been adopted in this study facilitates the selection of alternatives by calculating an overall value through the "sum of weighted scores" (Ishizaka *et al.,* 2013; Bollen *et al.,* 2007; Rana *et al.,* 2022). It categorizes research locations based on suitability for specific objectives, assuming more significant components contribute to higher final values (Matin *et al.,* 2016; Esangbedo & Che,2016; Kolios *et al.,* 2016; Nekolova *et al.,* 2015). Beyond socio-economic status, various research domains have turned their attention to the WSM for appraising potential statuses (Paul *et al.,* 2015; Ocampo *et al.,* 2023; Rao *et al.,* 2019; Al Mamun & Mitra 2012). The Weighted Sum Method (WSM) involves a systematic process encompassing five sequential steps.

Step 1: Level-1 Parameters and Weight Assignment

The different parameters for assessing socioeconomic status were selected after a thorough literature review. The assessment of SES encompasses a broad spectrum of factors, and in the context of the study area, four broad parameters, namely Demography, Housing, Health, and Education, have been identified as level-1 indicators for evaluating Socioeconomic Status in the study area.

There were similar characteristics or levels for a single parameter while assessing block level Socio-economic Status. Hence, depending upon the regional setting the weight values of each of the four parameters, mentioned above, were assigned. This assignment of weights was worked through expert opinion survey, interview/subjective knowledge. In the first step, four distinct weights are taken into consideration: De for demography, Ho for housing, He for health, and Ed for education.

Step 2: Level-2 Variables and Weight Assignment

Each of level-1 parameters consists of set of variables those are considered as level-2 variables. These sets are explained here under.

1) Demographic parameters (De) include yearly income, occupation, age structure, sex ratio and whether the family meets the family expenses

2) Housing parameter (Ho) include household density, house type, households within house, room area, room sharing ratio, ventilation, latrine

type, latrine location, age of house, cowshed location and house satisfaction

3) Health parameter (He) include morbidity ratio, B.M.I, regular water supply, health institutions/000 population, wastage disposal, dustbin availability, removal of dustbins, sewerage facility and closed sewerage.

4) Education Parameters include (Ed) include literacy rate, male literacy rate, female literacy rate, schools per thousand population, levels of education, teacher: institute ratio, pupil: teacher ratio and pupil: institute ratio.

Step 3: Intra- Variable Scaling

Each variable was analysed using a 5-point ordinal scale based on disparities in qualitative and quantitative assessment in which 1 refers to the lowest quality and 5 indicates the highest quality. For simplicity each category was given a coding value, with 0.2 being the lowest, followed by 0.4, 0.6, 0.8 and 1 being the highest. (Al Mamun & Mitra 2012).

Step 4: Computation of Aggregate Potential Value

Final results are an additive aggregation of each block's Socio-economic Status which is expressed as follows:

Socio-economic Status (SES) = Demographic Aspects (De) + Housing (Ho) + Health (He) + Education (Ed)

Or

Socio-economic Status (SES) = WDe*[w1s1 + w2s2 +…. +wnsn] + WHo*[w1s1 + w2s2 +…. +wnsn] + WHe*[w1s1 + w2s2 + …. +wnsn] + WEd*[w1s1 + w2s2 + …. +wnsn]

Or

Socio-economic Status (SES) = $\Sigma Wi*[\Sigma wjsj]$ where Wi is the weight of Parameter level 1 for ith parameter, wj is weight of variable level 2 for jth variable and sj is the scaling grade for jth variable of level 2. Value of Wi and wj ranges from 0-1 and sj has 5 different values (0.2, 0.4, 0.6, 0.8 and 1).

Step 5: Grouping of blocks and analysis

List of blocks and corresponding Socio-economic status values (in aggregate and dispersed) were evaluated. The blocks were then classified into three groups depicting High, Medium and Low SES based on different parameters. The mean values of the block values were used to measure each group's SES. This provided a clearer picture of the quality of each characteristic in each block and enabled the development of suggestion for future development.

RESULTS AND DISCUSSIONS

The main focus of this study has been to understand and evaluate the Demographic, Housing, Health and Educational aspects of the region. For assessing the socioeconomic status in the study area, the Demographic, Housing, Health and Educational parameters were further divided of 33 sub variables. As per the opinion, weights (Wi) for Demographic Aspects, Housing, Health and Education have been considered as 0.4, 0.3,0.2 and 0.1 (table 1) respectively. Demographic parameter includes (5) variables, housing parameter (11), Health parameter (9) and Education Parameter (8) variables. (Table 2).

Table1. Weights of Socio-Economic Parameters

Parameters	Rank	Weight
Demography	4	0.4
Housing	3	0.3
Health	2	0.2
Education	1	0.1
Sum	*10*	*1.0*

Table 2. Weights of Socio-Economic Variables

Demography			Health		
Variables	*Rank*	*Weightage*	*Variables*	*Rank*	*Weightage*
Yearly Income	5	0.33	Morbidity Ratio	9	0.20
Meeting Family Expenses	4	0.27	Body Mass Index	8	0.18
Occupation	3	0.20	Regular Water Supply	7	0.16
Age Structure	2	0.13	Health Institutes /000 Population	6	0.13
Sex Ratio	1	0.07	Wastage Disposal	5	0.11
Total	15	1.00	Dustbin Availability	4	0.09
Housing			Removal of Dustbins	3	0.07
Variables	*Rank*	*Weightage*	Sewerage Facility	2	0.04
House Type	11	0.17	Closed Sewerage	1	0.02
Households within House	10	0.15	**Total**	45	1.00
Room Area	9	0.14	**Education**		
Room sharing Ratio	8	0.12	*Variables*	*Rank*	*Weightage*
Ventilation	7	0.11	Total Literacy	8	0.22
Latrine Type	6	0.09	Male Literacy	7	0.19
Latrine Location	5	0.07	Female Literacy	6	0.17
Age of House	4	0.06	Schools/000 Population	5	0.14
Cowshed location	3	0.04	Educational Level	4	0.11
Household Density	2	0.03	Teacher: Institute Ratio	3	0.08
Housing Satisfaction	1	0.01	Pupil: Teacher Ratio	2	0.06
Total	66	1.00	Pupil: Institute Ratio	1	0.03
			Total	36	1.00

The 5-point scaling of an individual variable was framed on the basis of suitable logical interpretations to quantify the Socio-economic indicators wherein 1 refers to worst situation and 5 as the best. Interpretations of comparative marking of 1-5 are based on quality of the variable. A colour range from has been applied for 1-5 scales respectively. For ease of computation, the values from 0.2 – 1.0 has been provided. The values are demonstrated in Table 3. The color scheme comprised of three colours namely green, yellow and red wherein green represented   high socio-economic status, yellow was labelled for medium and subsequently red was marked for low socio-economic characteristics.

Table 3. Quality value of selected Socio- economic variables

Block	De1	De2	De3	De4	De5	Ho1	Ho2	Ho3	Ho4	Ho5	Ho6	Ho7	Ho8	Ho9	Ho10	Ho11	He1	He2	He3	He4	He5	He6	He7	He8	He9	Ed1	Ed2	Ed3	Ed4	Ed5	Ed6	Ed7	Ed8
Leh	0.7	0.4	0.8	0.6	0.8	0.2	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.2	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.6	0.8
Nimmo	0.7	0.6	0.6	0.6	0.8	0.6	0.7	0.6	0.7	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.6	0.2	0.8	0.8	0.8	0.8	0.2	0.5	0.5	0.6	0.6	0.8	0.4	0.8	0.8	0.6	0.2
Nyoma	0.3	0.8	0.5	0.6	0.6	0.6	0.7	0.6	0.7	0.8	0.7	0.8	0.8	0.7	0.8	0.8	0.6	0.4	0.8	0.4	0.4	0.2	0.2	0.4	0.4	0.6	0.6	0.6	0.6	0.5	0.4	0.4	0.6
Rupshu	0.4	0.6	0.4	0.4	0.4	0.6	0.4	0.6	0.5	0.6	0.5	0.6	0.8	0.5	0.6	0.6	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.4	0.4	0.4	0.8	0.6
Chunathe	0.7		0.5	0.4	0.4	0.6	0.4	0.2	0.3	0.4	0.3	0.2	0.2	0.4	0.2	0.2	0.6	0.6	0.8	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.6	0.6	0.2	0.4	0.8	0.2
ng	0.8		0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.6	0.3	0.2	0.4	0.2	0.2	0.2	0.4	0.4	0.4	0.8	0.8	0.4	0.4	0.4	0.4	0.6	0.6	0.8	0.4	0.5	0.4	0.6	0.6
Durbuk	0.3	0.6	0.5	0.5	0.4	0.8	0.4	0.2	0.3	0.4	0.3	0.6	0.6	0.4	0.2	0.2	0.2	0.6	0.8	0.2	0.2	0.2	0.2	0.3	0.4	0.4	0.4	0.4	0.6	0.5	0.6	0.2	0.6
Kharu	0.4	0.2	0.5	0.5	0.4	0.6	0.5	0.4	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.2	0.4	0.8	0.8	0.4	0.6	0.2	0.4	0.4	0.4	0.8	0.4	0.6	0.5	0.6	0.8	0.2
Chachut	0.7	0.8	0.6	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.8	0.4	0.7	0.8	0.2	0.8	0.4	0.4	0.6	0.6	0.4	0.2	0.3	0.3	0.4	0.8	0.2	0.2	0.4	0.6	0.4	0.4
Thiksey	0.6	0.8	0.6	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.7	0.8	0.6	0.6	0.8	0.8	0.2	0.2	0.4	0.6	0.6	0.6	0.2	0.6	0.6	0.2	0.8	0.6	0.6	0.4	0.6	0.8	0.4
Khaltsi	0.6	0.8	0.5	0.6	0.6	0.2	0.6	0.5	0.5	0.4	0.5	0.6	0.6	0.6	0.4	0.2	0.4	0.4	0.8	0.8	0.8	0.8	0.2	0.4	0.4	0.6	0.4	0.2	0.4	0.3	0.6	0.6	0.4
Saspol	0.5	0.6	0.6	0.6	0.6	0.2	0.8	0.6	0.8	0.8	0.8	0.6	0.6	0.8	0.8	0.6	0.6	0.2	0.4	0.8	0.8	0.6	0.4	0.4	0.4	0.6	0.4	0.6	0.2	0.3	0.6	0.8	0.2
Lingshed	0.4	0.6	0.4	0.4	0.4	0.4	0.5	0.3	0.3	0.2	0.3	0.2	0.2	0.5	0.3	0.2	0.6	0.2	0.6	0.2	0.4	0.4	0.4	0.3	0.3	0.2	0.8	0.6	0.8	0.7	0.2	0.6	0.4
Skurbuchan	0.5	0.8	0.3	0.4	0.2	0.6	0.2	0.2	0.3	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.6	0.8	0.8	0.4	0.2	0.2	0.3	0.6	0.6	0.4	0.4	0.5	0.2	0.6	0.4
n																																	
Disket	0.7	0.2	0.7	0.6	0.6	0.8	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.4	0.8	0.4	0.4	0.4	0.8	0.4	0.4	0.8	0.8	0.6	0.2	0.5	0.6	0.6	0.8
Turtuk	0.3	0.2	0.5	0.5	0.4	0.6	0.6	0.4	0.5	0.4	0.5	0.6	0.6	0.6	0.6	0.4	0.6	0.4	0.8	0.2	0.4	0.4	0.2	0.4	0.4	0.6	0.8	0.6	0.6	0.5	0.6	0.4	0.8
Panamik	0.4	0.4	0.8	0.7	0.6	0.6	0.7	0.7	0.8	0.6	0.8	0.8	0.8	0.7	0.6	0.8	0.8	0.4	0.8	0.8	0.8	0.4	0.4	0.4	0.4	0.6	0.6	0.8	0.6	0.7	0.4	0.6	0.4
Drass	0.5	0.2	0.5	0.6	0.6	0.4	0.7	0.4	0.4	0.4	0.3	0.8	0.4	0.7	0.4	0.4	0.4	0.4	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.4	0.4	0.4	0.8	0.3	0.2	0.6	0.6
Kargil	0.6	0.4	0.8	0.6	0.8	0.2	0.6	0.8	0.8	0.4	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.4	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.4	0.4	0.8	0.8	0.7	0.8	0.4	0.8
Gm. Pore	0.4	0.4	0.5	0.5	0.8	0.2	0.6	0.3	0.3	0.2	0.3	0.2	0.8	0.5	0.4	0.8	0.4	0.4	0.6	0.4	0.4	0.6	0.8	0.6	0.6	0.4	0.6	0.8	0.4	0.5	0.2	0.4	0.6
Sankoo	0.3	0.6	0.5	0.5	0.6	0.4	0.5	0.5	0.3	0.4	0.5	0.6	0.8	0.5	0.4	0.4	0.4	0.2	0.6	0.4	0.4	0.4	0.2	0.4	0.4	0.4	0.6	0.8	0.4	0.5	0.2	0.4	0.6
S. Chiktan	0.3	0.6	0.7	0.6	0.6	0.2	0.8	0.7	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.4	0.4	0.8	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.6	0.4	0.4	0.7	0.2	0.8	0.6
Shargole	0.5	0.6	0.8	0.6	0.8	0.4	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.6	0.4	0.8	0.6	0.6	0.8	0.8	0.8	0.8	0.6	0.6	0.8	0.8	0.7	0.8	0.4	0.6
Taisuru	0.3	0.6	0.4	0.2	0.4	0.6	0.2	0.3	0.4	0.4	0.4	0.2	0.2	0.2	0.2	0.6	0.2	0.4	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.4	0.2	0.4	0.3	0.2	0.4	0.4
Zanskar	0.4	0.6	0.4	0.4	0.6	0.6	0.3	0.4	0.4	0.4	0.4	0.2	0.4	0.3	0.3	0.4	0.6	0.2	0.8	0.4	0.4	0.8	0.2	0.3	0.3	0.4	0.6	0.2	0.4	0.4	0.2	0.8	0.2
Lungnak	0.5	0.6	0.4	0.2	0.2	0.6	0.3	0.4	0.3	0.4	0.3	0.2	0.2	0.3	0.2	0.2	0.2	0.8	0.4	0.2	0.2	0.2	0.4	0.3	0.3	0.2	0.6	0.2	0.4	0.4	0.2	0.8	0.2

Table 4. Aggregate Socio-economic values

Blocks	De	Ho	He	Ed	SES
Leh	0.742	0.746	0.674	0.616	0.717
Nimmo	0.646	0.641	0.596	0.520	0.622
Nyoma	0.501	0.590	0.493	0.470	0.523
Rupshu	0.464	0.440	0.314	0.410	0.421
Chumathang	0.457	0.495	0.293	0.398	0.430
Durbuk	0.527	0.528	0.501	0.458	0.515
Kharu	0.446	0.543	0.443	0.468	0.477
Chachut	0.421	0.509	0.314	0.410	0.425
Thiksey	0.642	0.662	0.493	0.456	0.599
Khaltsi	0.510	0.670	0.542	0.462	0.560
Saspol	0.586	0.631	0.431	0.522	0.562
Lingshed	0.457	0.495	0.199	0.386	0.410
Skurbuchan	0.347	0.356	0.171	0.364	0.316
Disket	0.622	0.593	0.596	0.510	0.597
Turtuk	0.446	0.561	0.491	0.458	0.491
Panamik	0.603	0.661	0.494	0.456	0.578
Drass	0.622	0.616	0.432	0.496	0.583
Kargil	0.731	0.733	0.661	0.538	0.697
Gm. Pore	0.397	0.489	0.331	0.402	0.463
Sankoo	0.547	0.533	0.493	0.468	0.524
S. Chiktan	0.597	0.695	0.501	0.488	0.596
Shargole	0.697	0.695	0.656	0.536	0.671
Taifsuru	0.322	0.395	0.174	0.364	0.319
Zanskar	0.527	0.460	0.290	0.382	0.464
Lungnak	0.380	0.433	0.162	0.378	0.445

Computed from Field survey 2021

(a)

(b)

(c)

(d)
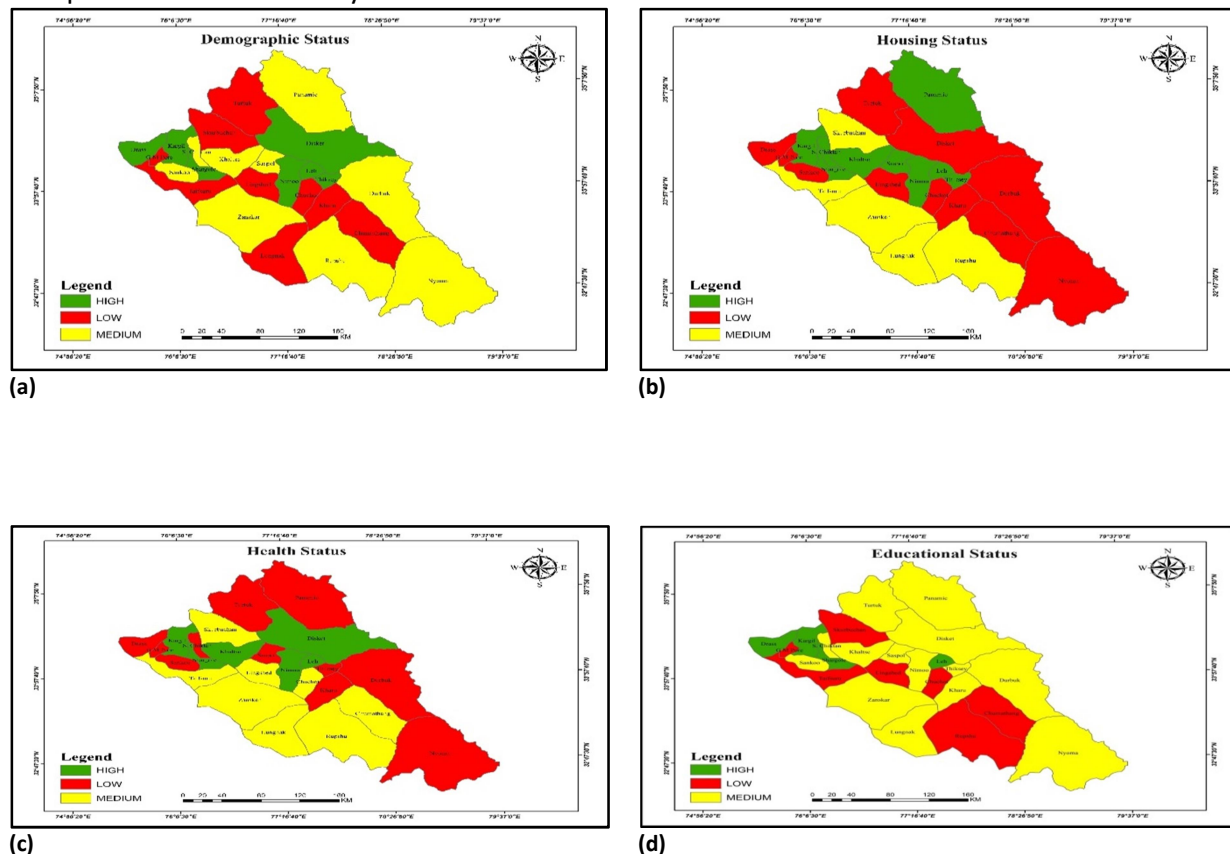
Fig. 2. Graphical representation of different socioeconomic parameters: (a) Demographic status, (b) Housing status, (c) Health status, (d) Educational status

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The demographic aspects across various blocks (table 4) in the Ladakh region range from 0.734 in Thiksey to 0.303 in Lungnak. Notably, Leh, Thiksey, Kargil, and Shargole blocks stand out with higher values (0.604- 0.742). Conversely, Nimmu, Nyoma, Chumathang, Durbuk, Chachut, Khaltsi, Saspol, Disket, Turtuk, Panamik, Drass, G.M. Pore, Sankoo, Shankar Chiktan, and Zanskar blocks are positioned at a medium level (0.463-0.603). In contrast, Rupshu, Kharu, Lingshed, Skurbuchan, Taifsuru, and Lungnak blocks exhibit comparatively lower values (0.322-0.462), indicating distinct demographic characteristics in these areas (figure 2 a).

The assessment of housing status in the Ladakh region reveals noteworthy variations (figure 2 b), with Shargole registering the highest rating at 0.789 and Skurbuchan at the lowest with 0.236. Highest housing standards (0.618-0.746) are prominently observed in Leh, Thiksey, Kargil, and Shargole blocks. Meanwhile, Nimmu, Nyoma, Durbuk, Chachut, Khaltsi, Saspol, Disket, Turtuk, Panamik, Drass, G.M. Pore, Sankoo, Shankar Chiktan, and Zanskar blocks exhibit a moderate housing status (0.487-0.617). In contrast, Chumathang, Rupshu, Kharu, Lingshed, Skurbuchan, Taifsuru, and Lungnak blocks demonstrate comparatively lower housing standards (0.356-0.486), highlighting diverse levels of housing infrastructure across the region.

The health status across various blocks in Ladakh displays considerable variability (figure 2 c), with Kargil recording the highest score at 0.748, while Taifsuru exhibits the lowest at 0.219. Leh, Durbuk, Thiksey, Kargil, Shankar Chiktan, and Shargole blocks demonstrate a high health status (0.504-0.674). Nimmu, Nyoma, Khaltsi, Saspol, Disket, Turtuk, Panamik, Drass, G.M. Pore, and Zanskar blocks showcase a moderate level of health status (0.333-0.503). Conversely, Chumathang, Rupshu, Chachut, Kharu, Lingshed, Skurbuchan, Sankoo, Taifsuru, and Lungnak blocks experience a lower health status (0.162-0.332), indicating varied health conditions across the region.

The educational landscape across Ladakh demonstrates significant variation (figure 2 d), with Leh securing the highest score at 0.788, while Drass registers the lowest at 0.265. Leh, Nyoma, Lingshed, Disket, Panamik, Kargil, and Shargole exhibit a high level of educational status (0.504-0.674). Nimmu, Rupshu, Chumathang, Durbuk, Kharu, Chachut, Thiksey, Skurbuchan, Turtuk, G.M. Pore, and Shankar Chiktan blocks indicate a moderate level of education (0.449-0.533). Conversely, Khaltsi, Saspol, Drass, Sankoo, Taifsuru, Zanskar, and Lungnak blocks experience lower educational levels (0.364-0.448), highlighting disparities in educational access and achievements across the region.

The reliability of the methodology has been proved by the overall socio-economic status (figure3). The highest value is obtained by Leh (0.717) and this place is considered as the primary urban core of Ladakh, followed by Kargil, Shargole, Thiksey and their Socio-economic status values have been quantified as 0.715,0.714 and 0.691 respectively. In these Blocks at least three out of the four parameters have high values compared to other blocks of the study area. On the other hand, around 15 reflected medium (0.450-0.583) and 6 blocks fall under the category of low (0.316-0.449) SES.
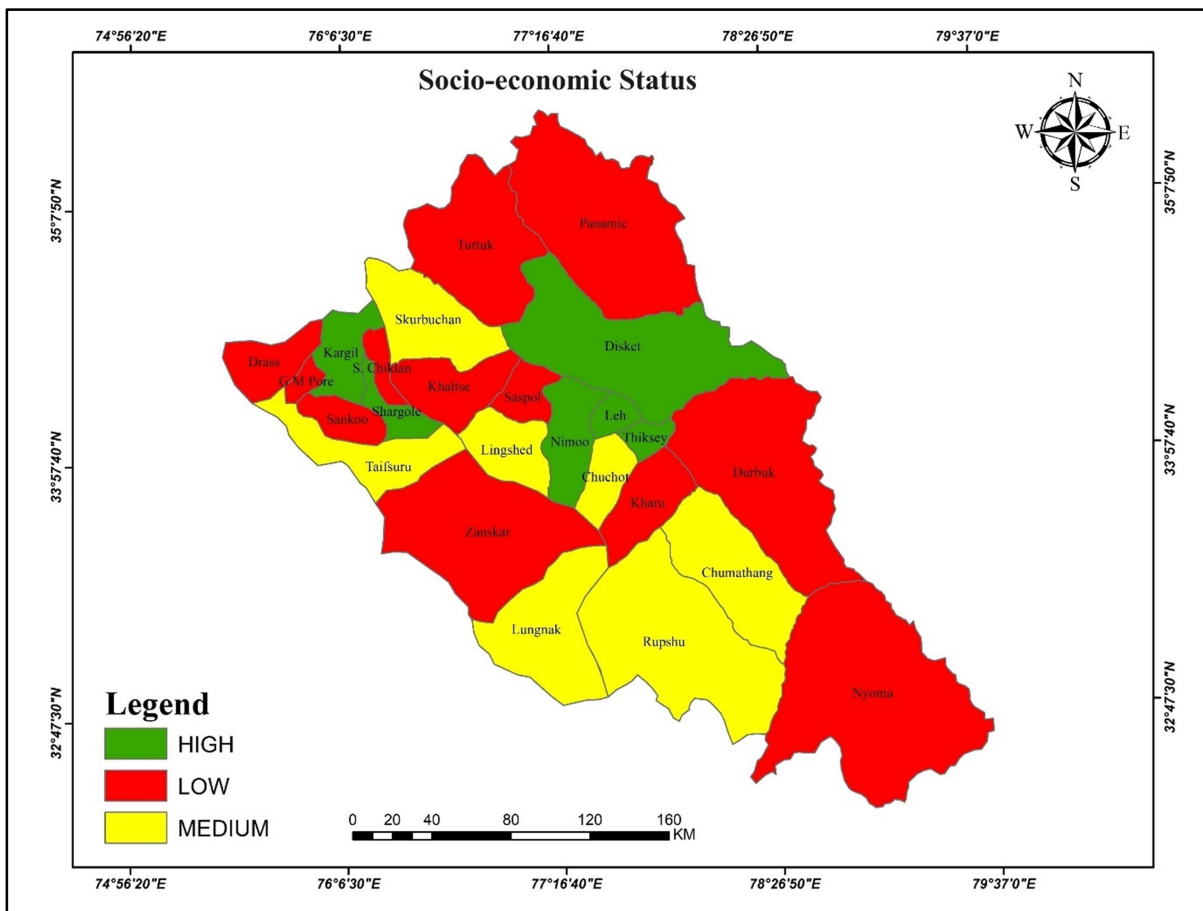
Fig. 3. Graphical representation of the overall socioeconomic status of Ladakh region.

The significance of socio-economic indicators is paramount (Lallukka *et al.,* 2007) in understanding the regional disparity dynamics of any region. The findings from the research aligned with the studies based on the metrics for assessing the well-being, progress, and disparities within a society or a broad geographical area (Frugoli *et al.,* 2015; Barrington & Escande,2018, Gledhil & James, 2012; Wiggering *et al.,* 2006) . Ladakh's socio-economic status is intricately shaped by its unique geographical and cultural characteristics (Barret & Bosak, 2018; Bhasin, 2008) relying on a combination of traditional livelihoods, including agriculture, tourism, and crafts, to sustain its economy (Tarbotton, 2000;

Bahuguna & Ramaswamy, 2022), which are inferred from the results of the current study .

Based on the results derived from the socio-economic trajectory of the region computed from the broad indicators (demographic, housing, health and education,) it is evident that the inter-block disparities are comparatively high in some pockets. The socio-spatial inequality charcteristics in terms of these indicators has resulted in the socio-economic gaps being widened and the strategies and policy framework needs to be intervened for the balanced and sustainable development in the region factoring in the geo-environmental and societal positioning of the region. The results also revealed the urbanization

and modernization trends in the Ladakh region leading to the mixed typology of socio-economic levels of development.

CONCLUSION

This study assessed the intricate dynamics inherent in Ladakh's socioeconomic landscape, revealing the multifaceted interplay of factors shaping its economic, social, and cultural dimensions. The research analysed demographic variables, housing conditions, health parameters, and educational aspects to provide a comprehensive understanding of the region's existing socioeconomic status. From the distribution of income to health outcomes and educational opportunities, each facet contributes to a socio-economic aspect of Ladakh's distinctive challenges and prospects. As Ladakh negotiates the delicate equilibrium between economic advancement, cultural preservation, and environmental sustainability, this research serves as a foundational framework for interpreting the region's dynamics and devising strategies to elevate its socioeconomic status.

Despite Ladakh's inherent natural beauty, it grapples with socio-economic challenges, including urban-rural income disparities, constraints in arable land availability, and obstacles in delivering education and healthcare facilities to remote communities. Development initiatives encompass poverty reduction programs, infrastructure development, and a concerted effort to balance modernization with environmental conservation. The insights derived from this work promise to significantly contribute to sustainable development initiatives and guide the implementation of targeted policy interventions. Practically, this implies the necessity of formulating and implementing

developmental strategies that exhibit a synergistic effect, wherein progress in one sector catalyzes advancements in others. From this perspective, it is off-putting to observe that, despite a sustained augmentation in index values across numerous sectors for most blocks, a substantial number of these administrative divisions persist in a state of underdevelopment across various dimensions. This situation underscores the inadequacy of the overarching socio-economic dispersion mechanism, indicating a failure in the transmission of development from more developed to less developed regions. Consequently, imperative measures for interregional and inter-sectoral development become paramount.

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