



Application of Geographic Information System (GIS) in Identifying Libraries in the Districts of West Bengal

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Abstract

Geographic Information System (GIS) is a technology that represents spatial data in an enhanced manner for utilisation in human resource development. This study aims to identify the location of different libraries using ArcGIS and also determine the library health of the districts of West Bengal. Location maps have been prepared showing the location of government libraries, government sponsored libraries, aided libraries, century old libraries and other important libraries in the districts of West Bengal. A choropleth map has been prepared using the ratio between the total number of libraries in each district and the existing literate population of the same district (derived from Census of India, 2011) to depict the library health of that district. A higher ratio value signifies that a greater number of the population depends on the services provided by a limited number of libraries which highlights the poor library health of that district and vice versa. It has been found that Kolkata, Alipurduar and Kalimpong have the lowest library population ratio indicating a very good library health of these districts. However, the situation is very serious in terms of library health in Jalpaiguri, Paschim Bardhaman, East Midnapore, West Midnapore and Bankura where only a few libraries are located to be accessed by a considerably large number of literate population. Therefore, this study recommends increasing the existing number of libraries by constructing new libraries in these districts, so that the people can properly access the library services.

Keywords: District, Geographic information system, Library, Map, Population, West Bengal

1. Introduction

Geographic Information System (GIS) is a technology that is based on computers and used in receiving, storing, analysing and presenting information regarding the different locations on the earth's surface like buildings, markets, airports, forests and others. Such locations can be represented in different ways like latitudinal and longitudinal extension, address and pin codes. The data is handled in the GIS interface in an enhanced manner to create logical patterns, trends and relationships existing in the data. In other words, the spatial data can be

captured and maintained by this technology that is ultimately utilised in the development of human resources (Bhatta, 2020).

GIS has emerged as an advanced map-making process that can superimpose data into different layers in this technology. For example: the pollution data of any country can be superimposed with the GDP of that country to find the relation between the rate of development and the pollution level. The maps created by GIS display the numbers, density and concentration of the population, workers or literates of any region. GIS is used to study the changes in any aspect of the earth



with time. Satellite or remote sensing data is used to monitor such changes in glacial cover, forest cover, changes in river courses, expansion of desert areas which forms the base for scientific investigations and developmental planning. Lastly, GIS technology helps in the integration and operation of different communication lines (transport, telephone, internet) and helps to provide better infrastructural connectivity (Elangovan, 2006).

Library is an important component of any educational institution (Biswas, 2022; Pandit & Biswas, 2023). It acts as a storehouse of past and present knowledge and information (in hardcopy/ softcopy) in a systematic manner that can be easily accessed by future generations for advanced research or recreational purposes (ISO, 2006).

There are a variety of services in a library that can be well performed with GIS support like acquiring data, collecting books and journals, locating books on shelves, managing the issue and return of books, etc. Several research papers emphasised these aspects of the application in library management. However, this study aims to identify the location of different libraries using GIS technology.

Hence, Geographic Information System has been developed as an effective tool for spatial analysis by combining two types of data. In identifying the location of the libraries of any region, spatial data is defined as the actual location (address) of the library, while information like the name of the library, working hours, specialisation and capacity of the libraries are included in the attribute data.

2. Review of literature

Several studies highlight the use of Geographic Information System (GIS) in the management of various library services.

Formulation of maps has always been an essential component of the application of GIS in library. Howser and Callahan (2004) opined that libraries can work in collaboration with other academic departments to overcome the gap in GIS access and support. Different software in GIS technology can manipulate numeric and geospatial data to create visually representative maps. Xia (2005) pointed out the problem of the library users in locating a library item. So, the author explained how a mapping system was developed by GIS technology which provided a systematic analysis of spatial data of collection locations and represented the analytical results in the form of maps. According to Bishop and Mandel (2010), libraries could use GIS in practice and research which would generate more information in comparison to manual tables and text for spatial analysis of library services. Later, Bishop et al. (2011) discussed the practical issues of GIS for library research based on the knowledge accumulated from ongoing GIS projects in the libraries. Atkins (1999) explained the ability of GIS to use the available information in an efficient way which ultimately reduces the operation cost and makes the services accessible to a larger number of users. Deckelbaum and Bruman (1999) reported that GIS could develop relationships among features that result in problem solving or decision making. In this way, decisions can be made about where to locate a new library in any place or region. Later, Park (2012) studied the importance of physical accessibility to a library. GIS improves physical accessibility by developing a road-network-based distance measure that includes descriptive and statistical analysis. So, GIS can be implemented to study these geography related factors, assist in mapping and finally improve spatial information services in the library. According to Kim and Lee (2021), certain attractive factors need to be analysed to



determine to what extent public libraries are accessible. Lastly, Plassche (2022) also examined the use of maps and geospatial information managed by Geographic Information System (GIS) in identifying the library positions in any country.

3. Significance of the study

From the literature review, it can be well understood that Geographic Information System can play a significant role in the efficient and effective working of the library system. GIS is utilised for easy accessing different items in library by maintaining and updating maps and tables as well as in complex decision making that involves feasibility analysis of the location of library. However, there is a shortage of research regarding the location of libraries in the states of India that can emphasise the accessibility of libraries by the literate population. So, this study focuses on the identification of different types of libraries in West Bengal with the help of GIS that can overcome the existing gap and also find out the districts where new libraries are required for the population.

4. Categories of libraries in West Bengal

Some sources highlight different categories of libraries in any region. However, in this study, five types of libraries have been considered which are located in the 23 districts of West Bengal: Aided Library, Government Library, Government Sponsored Library, Century Old Library and Other Important Library (Department of Mass Education Extension and Library Services, 2023).

4.1 Government library

Government is primarily responsible for the infrastructural development and welfare of the people. So, the government established many non-profit libraries which are run by the funds provided by the government itself. The

uses of such libraries are education, information, recreation and research. These libraries are situated in the urban areas of the districts of West Bengal and some of them charge nominal fees as caution deposits for the users.

4.2 Government sponsored library

These libraries are situated in the urban as well as rural areas of the districts of West Bengal. Sub-divisional library, district library, town library, rural library and primary units are included within the Government sponsored libraries which are managed by the Municipality or the Gram Panchayat Samiti.

4.3 Aided library

The name 'Aided Library' suggests that these libraries are supported with funds provided by the government. They have a collection of rare and valuable books and documents along with various texts and reference books which are made accessible to the public for borrowing. Some of these libraries have reading rooms or halls for the students and public during specified times.

4.4 Century old library

These libraries were built more than a hundred years ago and so they are considered as the heritage asset of the district. Most of these libraries have significant historical backgrounds and they are storehouses of rare books, journals, manuscripts, periodicals and old newspapers. Some libraries have preserved old coins, paintings and sculptures which attract many tourists to a great extent.

4.5 Other important library

These are special libraries that cater to the specific needs of organisations, specialised users, or professions. They are mainly found in government agencies, research institutions, law firms, military bases, medical colleges and museums.



Depending on the priority of the institution, special libraries may or may not be accessible to the general public. Such libraries play an important role in the scientific investigations, innovation and promotion of knowledge within specialised fields.

5. Objectives

- To identify the different types of libraries in the districts of West Bengal
- To locate these libraries in 23 districts of West Bengal with the help of Geographic Information System (GIS)
- To understand the library health of the districts of West Bengal.

6. Methodology

In ArcGIS, geospatial data can be created and stored in different formats. The primary data types are Raster and Vector. Raster data is mainly continuous data without any definite boundaries. It is a type of spatial data that consists of a matrix of cells organised into rows and columns in which each cell represents specific information known as pixels. Raster data also includes remote sensing images like satellite imagery

and aerial photos. In the present study, the scanned map of West Bengal with district boundaries is the raster data used. Vector data is represented as either points, lines or polygons. It is a type of spatial data that has discrete boundaries. The location of the libraries identified by a point feature is the vector data here and the district boundaries are marked as polygons (Graser, 2016).

In ArcGIS, shape files have been created from Arc Catalogue. Then the different types of libraries were searched from Google Earth with their names and locations and later symbolised the points. These points are saved in Keyhole Markup Language (kml) and then the kml points are converted in ArcGIS and plotted on the map of West Bengal. Three maps have been created showing the location of different categories of libraries in the districts of West Bengal. A choropleth map has been prepared using the ratio between the total number of libraries in each district and the existing literate population of the same district (derived from Census of India, 2011) to determine the library health of that district.

7. Result and discussion

Table 1 has been prepared to show the total number of libraries in the 23 districts of West Bengal.

Table 1: Different categories of libraries in the districts of West Bengal

Sl. No.	DISTRICT	Aided Library	Century old Library	Govt Library	Govt sponsored Library	Other Important Library	Total
1	Alipurduar	-	-	-	1	-	01
2	Bankura	-	-	-	4	-	04
3	Birbhum	-	2	-	10	-	12
4	Koch Behar	-	-	1	7	-	08
5	Dakshin Dinajpur	-	-	-	3	-	03
6	Darjeeling	-	-	1	6	-	07



Sl. No.	DISTRICT	Aided Library	Century old Library	Govt Library	Govt sponsored Library	Other Important Library	Total
7	Hugli	-	12	1	15	-	28
8	Haora	1	11	-	4	-	16
9	Jalpaiguri	-	-	-	4	-	04
10	Jhargram	-	-	-	1	-	01
11	Kalimpong	-	-	-	1	-	01
12	Kolkata	3	22	3	3	5	36
13	Malda	-	-	-	5	-	05
14	Murshidabad	-	2	-	9	-	11
15	Nadia	1	3	-	5	-	09
16	North 24 Parganas	-	8	2	27	-	37
17	Paschim Bardhaman	-	1	-	3	-	04
18	Purba Bardhaman	-	1	-	16	-	17
19	West Midnapore	-	1	-	6	-	07
20	East Midnapore	-	-	1	6	-	07
21	Purulia	-	-	1	5	-	06
22	South 24 Parganas	1	8	-	14	-	23
23	Uttar Dinajpur	-	-	1	3	-	04

(Source:https://www.collegeadmission.in/Other%20Information/Library/India/State_Wise/WestBengal/Government_Libraries.shtml (Accessed on 23rd March 2023).

From table 1, it can be clearly stated that there is an inequality in the total number of libraries found in the different districts of West Bengal. Districts like North 24 Parganas, Kolkata, Hugli and South 24 Parganas have having good number of libraries in comparison to the newly formed districts of Kalimpong, Alipurduar and Jhargram. The number of libraries is also less in Jalpaiguri, Uttar Dinajpur, Dakshin Dinajpur, Malda and Bankura. Kolkata is the only district where all the five categories of libraries are present. In Purba Bardhaman, there are 17 libraries; while in Paschim

Bardhaman, only 4 libraries are located.

Location maps (Map 1, 2 and 3) have been prepared using ArcGIS for better visualisation of the location of Government libraries, Government sponsored libraries, aided libraries, century old libraries and other important libraries in the districts of West Bengal.

Firstly, map1 shows that there are a few government libraries which are found in Koch Behar, Darjeeling, Hugli, Kolkata, North 24 Parganas, East Midnapore, Purulia and Uttar Dinajpur and aided libraries are found in Haora, Kolkata, Nadia and South 24



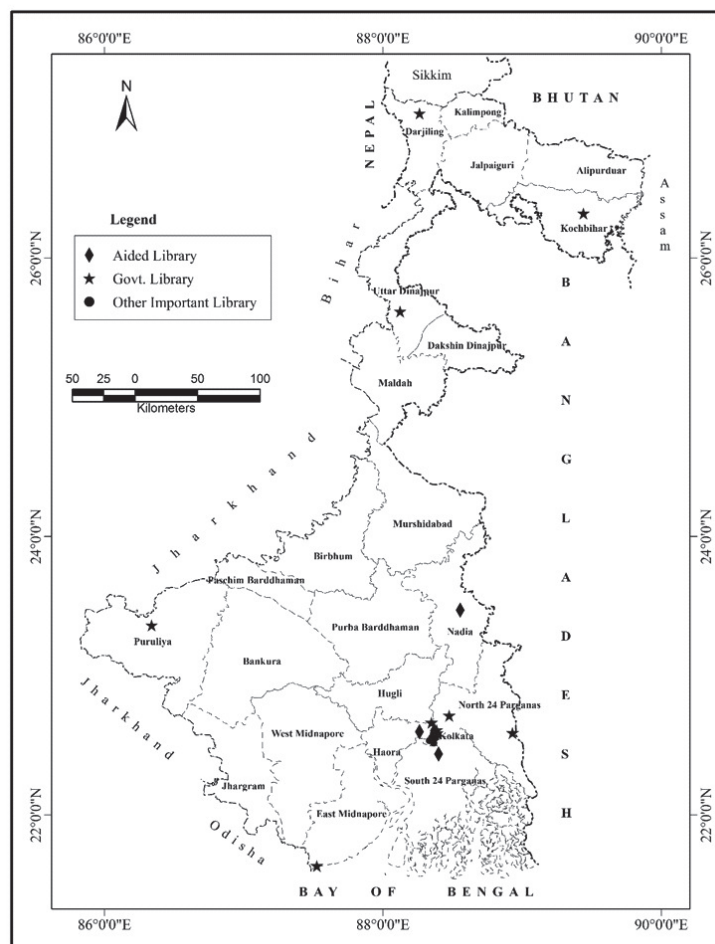
Parganas. Moreover, out of the 41 other important libraries of Kolkata, only 5 selected libraries (National Library, Asiatic Society Library, Bangiya Sahitya Parisad, Bidhan Chandra Granthagar and Ramkrishna Mision Institute of Culture Library) have been plotted considering the small area of Kolkata district.

Secondly, map 2 shows that the government sponsored libraries are located in all the 23 districts of West Bengal. There are many government sponsored libraries in the southern districts of Hugli, North 24 Parganas and South

24 Parganas which have clustered along the boundaries of these three districts. However, the government sponsored libraries are well distributed throughout the rest of the districts.

Thirdly, Map 3 shows that there are many libraries in Hugli, Haora and Kolkata which are about a hundred years old and are still serving the population of these districts. A few century old libraries are also located in Murshidabad, Nadia, North 24 Parganas, Purba and Paschim Bardhaman, West Midnapore and South 24 Parganas.

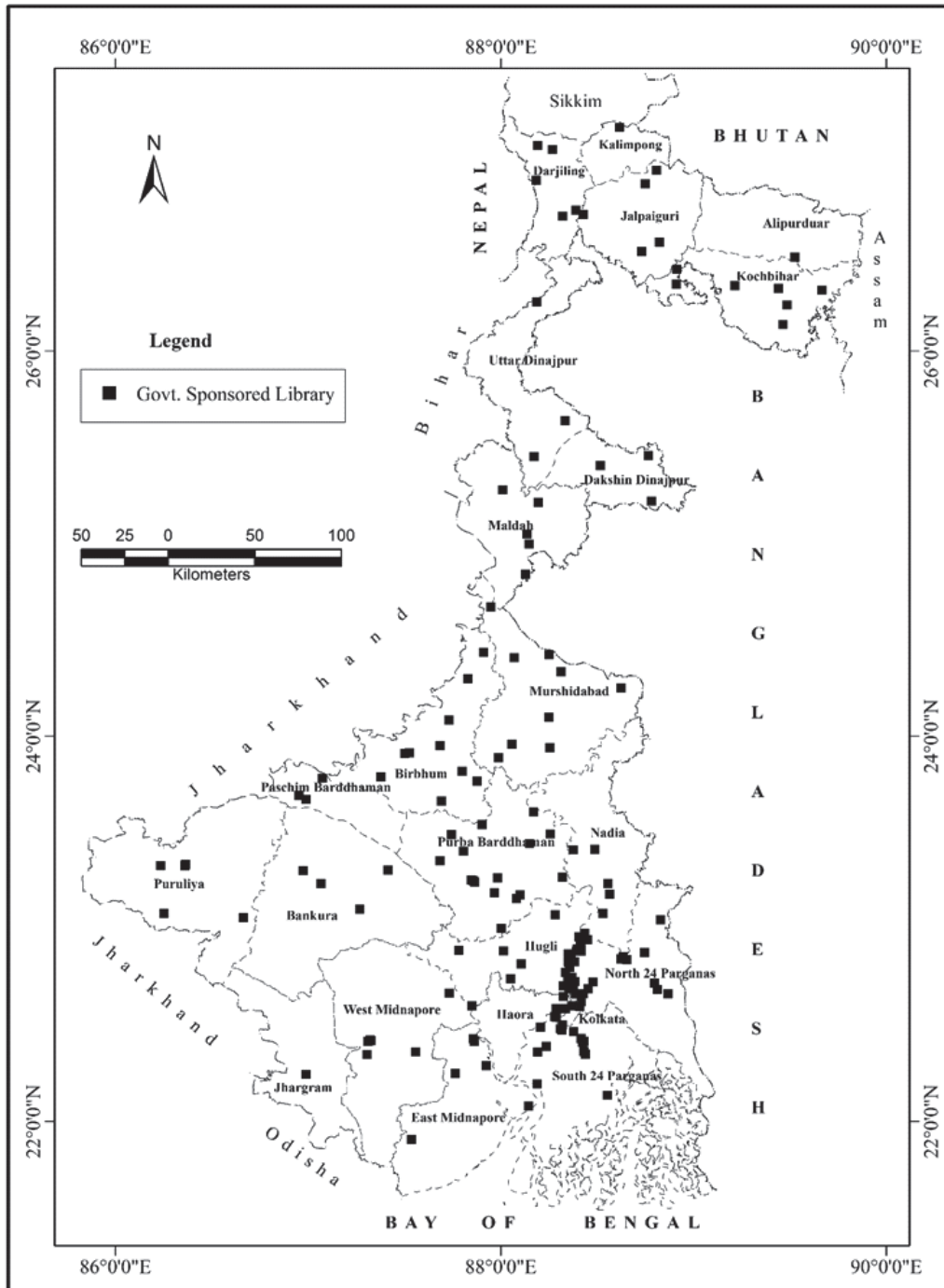
Map 1: Location map of aided, government and other important libraries of West Bengal



(Source: Prepared by author)



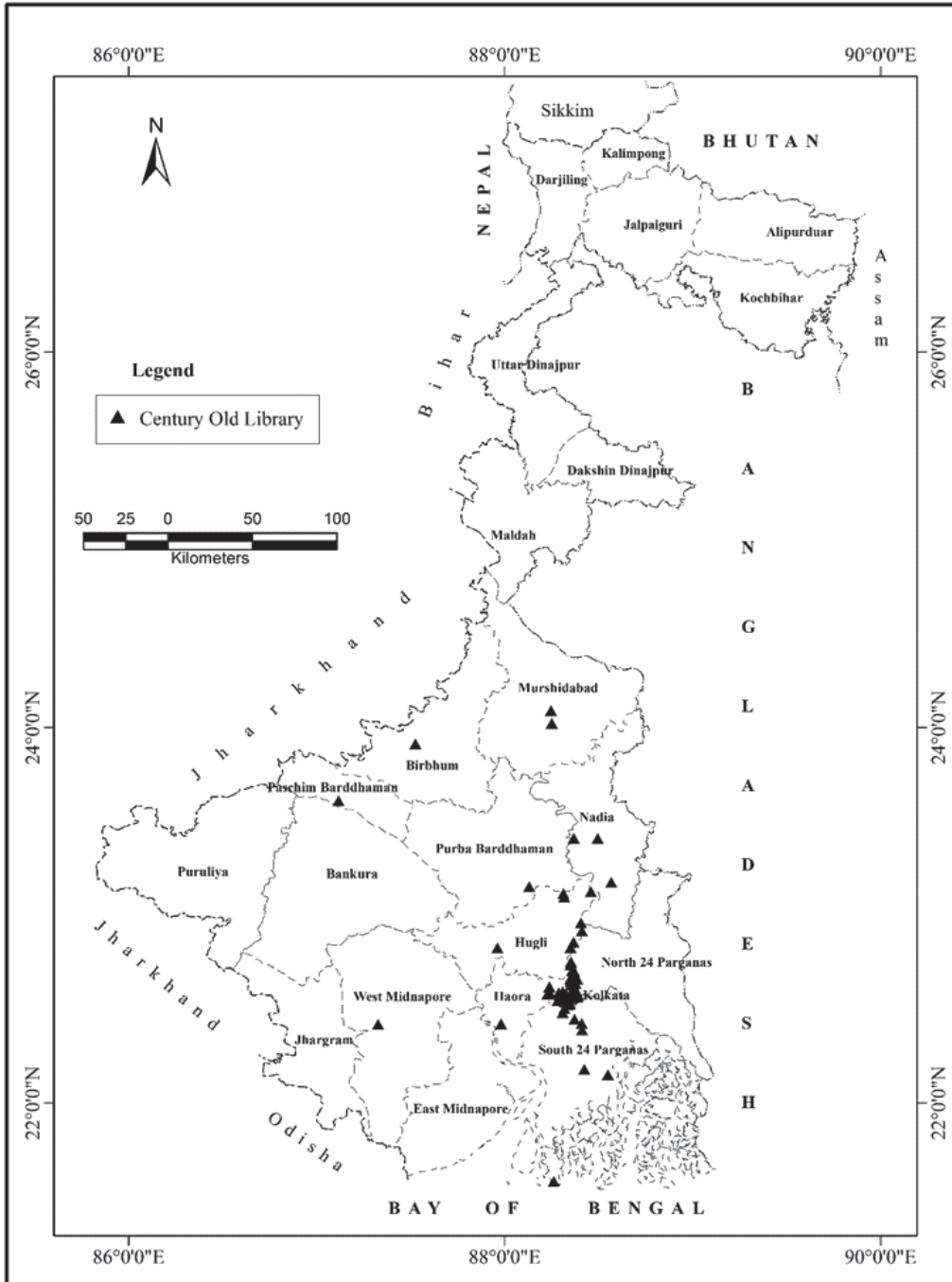
Map 2: Location map of government sponsored libraries of West Bengal



(Source: Prepared by author)



Map 3: Location map of century old libraries of West Bengal



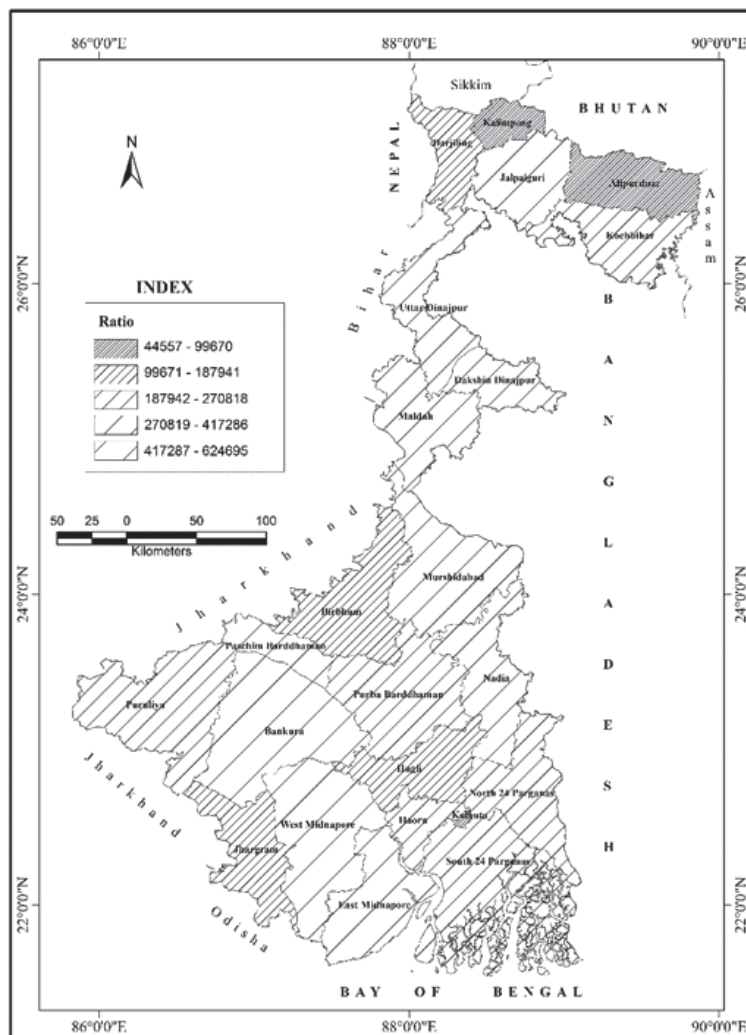
(Source: Prepared by author)



Lastly, a choropleth map (Map 4) has been prepared to show the library population ratio of the districts of West Bengal. A total number of libraries located and the total number of literate population of each district has been taken into consideration for calculating the library population ratio. The library population ratio denotes the library health of the district which indicates whether the existing number of libraries are sufficient

to provide the necessary library services to those people who are accessing the library or not. A higher value of the ratio signifies that a greater number of the population depends on the services provided by a limited number of libraries which highlights the poor library health of that district. On the other hand, the lower value of this ratio points to the fact that the people in need of library services are well catered by the existing libraries of that district.

Map 4: Choropleth map showing library population ratio of districts of West Bengal



Source: Prepared by author

**Table 2: Library population ratio of the districts of West Bengal**

SI No.	Ratio (Class)	Number of Districts	Name of Districts	Remarks
1	44557 - 99670	3	Kolkata, Alipurduar, Kalimpong	Very good library health
2	99671 – 187941	4	Darjeeling, Birbhum, Jhargram, Hugli	Moderately good library health
3	187942– 270818	6	Koch Behar, PurbaBardhaman, Purulia, Haora, North 24 Parganas, South 24 Parganas	Moderate library health
4	270819– 417286	5	Uttar Dinajpur, Dakshin Dinajpur, Malda, Murshidabad, Nadia	Moderately bad library health
5	417287 - 624695	5	Jalpaiguri, Paschim Bardhaman, East Midnapore, West Midnapore, Bankura	Very bad library health

It is very clear from table 2 that only Kolkata, Alipurduar and Kalimpong are having the lowest library population ratio indicating very good library health of these districts. This is because the highest number of libraries are located in Kolkata which are accessible to the literate population. Both Alipurduar and Kalimpong districts have one library each, but a lower number of the literate population has resulted in good library health in these districts. However, the situation is very serious in terms of library health in Jalpaiguri, Paschim Bardhaman, East Midnapore, West Midnapore and Bankura where only a few libraries are located to be accessed by a considerably large number of literate population. Therefore, it is necessary to increase the number of libraries in these districts by constructing new libraries, so that the people can properly access the library services.

8. Conclusion

Geographic Information System (GIS) can be widely used in identifying complex problems and decision making. It also prioritises the foundation for mapping and analysis in any multidisciplinary research. The maps show the highest and the least number of different types of libraries located in the districts of West Bengal. Moreover, this study has identified the districts that do not have a sufficient number of libraries to accommodate the existing literate population of those districts. The choropleth map gives a proper visualisation of this problem. Availability of libraries in good numbers and providing quality services to the people of any region are essential for the academic as well as overall development of that region.



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