



Sub-National Governance  
Programme

# USE OF GIS FOR PROBLEM-SOLVING & DECISION-MAKING IN SHEIKHUPURA & VEHARI



## 1. Introduction

The Government of Punjab is implementing the Sub-National Governance (SNG) Programme with the assistance of the UK's Department for International Development. SNG aims to improve basic service delivery in health and education in six districts in Punjab. The goals are to ensure use of evidence in decision-making by sub-national governments, improve their responsiveness to people's needs, and enhance their capacity to deliver basic services. To support the achievement of these objectives, the SNG Programme, among other things, established Geographic Information System (GIS) cells, on a pilot basis, in two districts of Punjab – Sheikhpura and Vehari. The purpose of these cells is to allow district governments to use GIS-based tools for effective planning and monitoring of service delivery, particularly in the health and education sectors. Based on the results of these pilot cells, SNG is now planning to establish GIS cells in the remaining four SNG districts.

## 2. What is GIS?

GIS involves geo-coding data and placing it on maps generated through a variety of formats including satellite imagery, in ways that allow spatial analysis of the data, i.e. understanding where things are and how they relate to each other.

ArcGIS, the software used for the generation of maps for visualization and communication of spatial and non-spatial information, allows for the creation of a number of data layers that can be stored and managed efficiently, so that it is possible to review them in a variety of ways, depending on the purpose of use. It is possible to effectively monitor and update stored data and to add layers over time, in response to changing requirements.

## 3. Implementation of GIS in pilot districts

The SNG Programme assisted the district governments Vehari and Sheikhpura, in the adoption of GIS. Baseline data were prepared and validated to ensure the accuracy of the information and a **district dashboard** was developed to provide service delivery managers easy access to maps through a user-friendly, menu-driven interface. GIS analysts were trained and appointed to these cells so as to enable district governments to adequately interpret data and use them for decision-making.

In addition, capacity-building exercises were undertaken to ensure that the use of GIS maps was embedded into operational structures at the district level. Consequently, their use has been widely adopted by senior district government officials such as District Coordination Officers (DCOs), Additional District Collectors (ADCs), Assistant Commissioners (ACs), Executive District Officers (EDOs) and District Officers (DOs), etc.

Since their inauguration in February 2015, both of these cells have enhanced the district governments' capacity to deliver services not just in health and education sectors but increasingly in other sectors as well. The use of this technology has meant that fewer monetary and human resources are required by the district government for decision-making. Furthermore, the quality of decisions has also improved significantly with the help of GIS tools as these decisions are now based on credible evidence, truly reflective of the needs and requirements of the people.

## 4. Core government functions simplified by GIS

Development of district-level GIS capacity has allowed district governments to use geographic information to identify problems, design solutions, and constantly monitor/measure the impacts of decisions. GIS has simplified the following governance related functions:

- Planning, budgeting and monitoring of development activities (using maps depicting features like population of a given area or comparing service delivery performance across locations);
- Tracking progress against district education and health indicators (using maps tracking changes in performance over time);
- Carrying out needs assessments (using maps showing primary health and education facilities as underutilized, overcrowded, in need of repair, etc.); and
- Optimal allocation of resources against agreed criteria (using maps showing allocation of resources like staff, equipment etc.).

Text in the following three boxes shows areas where GIS has influenced planning and monitoring at district level:

### Box 1: Education

- Enrolments and retention at primary schools
- Staff rationalization to achieve optimal student-teacher ratios
- Optimal allocation of funds for repairs and provision of missing facilities

### Box 2: Health

- Improving accessibility of health care services
- Adequate provision of medicine
- Rationalisation of staff appointments, including for Medical Officers and Lady Health Workers; etc.
- Better provision of maternal, new-born and child health (MNCH) related services
- Deployment of vaccinators for comprehensive EPI coverage (Pentavalent, Measles, TT-2, Polio etc.)
- Effective surveillance and prevention of diseases such as dengue, gastroenteritis, diarrhoea, etc.

### Box 3: Additional areas

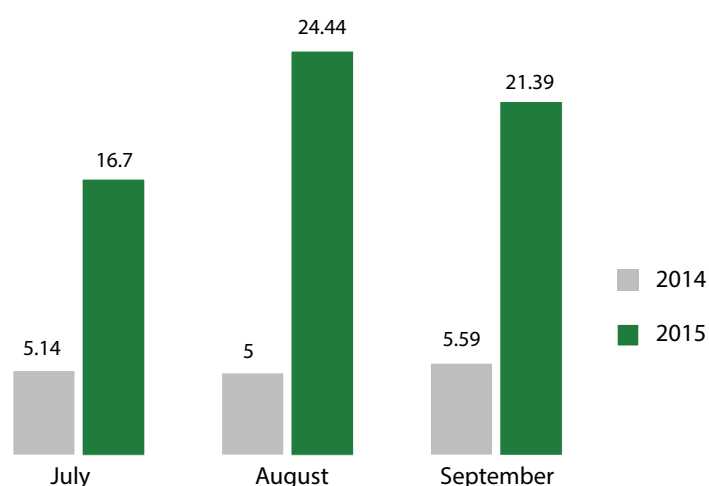
- Delimitation of constituencies for local government elections
- Evaluation of development projects
- Location marking of Ramzan Bazars, wheat procurement centres, and slaughter houses
- Flood preparedness (location marking of water bodies, health facilities, relief centres, veterinary relief centres and identification of most vulnerable areas during flood)
- Identification of new rating areas for assessment and collection of Capital Value Tax (CVT)
- Identification of areas not suitable for setting up of industries and jurisdictional areas for Assistant Inspectors Industries
- Spatial mapping of 100 villages for Open Defecation Free<sup>1</sup> areas
- Demarcation of police stations and beat boundaries for prevention of crime

<sup>1</sup> Open Defecation Free is a term used to connote areas where populations are using sanitation systems instead of practicing open defecation. Elimination of open defecation has been included in the Sustainable Development Goals due to its connection with high incidence of mortality in younger children.

## 5. Use of GIS as a decision-making tool

The standards of governance have improved in these pilot districts as decision-making is evidence-based and timely. For instance, the identification of new rating areas in Sheikhpura district helped improve the collection of CVT from Rs.15.73 million for the quarter July to September 2014 to Rs. 62.53 million in the same quarter in 2015, i.e., an increase of 298%<sup>2</sup>. A comparison of increases in collection of CVT for each month in the quarter is given in Figure 1.

Figure 1: Comparison of CVT collection for 2014 and 2015 (Rs. in millions)



GIS mapping promotes evidence based decision-making by making it easier to determine linkages, for instance between travel time to school (Figure 2) and school enrolment or dropout ratios, or between the accessibility of healthcare facilities and the health outcomes of a particular area. This enables appropriate, needs-based and equitable budgetary allocations for public welfare projects, allowing the benefits to reach the deprived segments of the population. In Vehari, GIS mapping helped to identify the most vulnerable areas significantly improving preparedness of local authorities for floods. In Sheikhpura, the optimal site for setting up a coal fired power plant (see Figure 5 below) was determined using spatial analysis.

Responsiveness of local governments to public needs has also been enhanced demonstrably. For instance, when a conspicuously large number of gastro patients reported to DHQ Sheikhpura (see Figure 6 below), the situation immediately drew the attention of concerned authorities. This impelled an investigation into the probable cause, which the district administration later identified as accidental mixing of potable and sewage water through old, rusted pipes, and the problem was rectified.

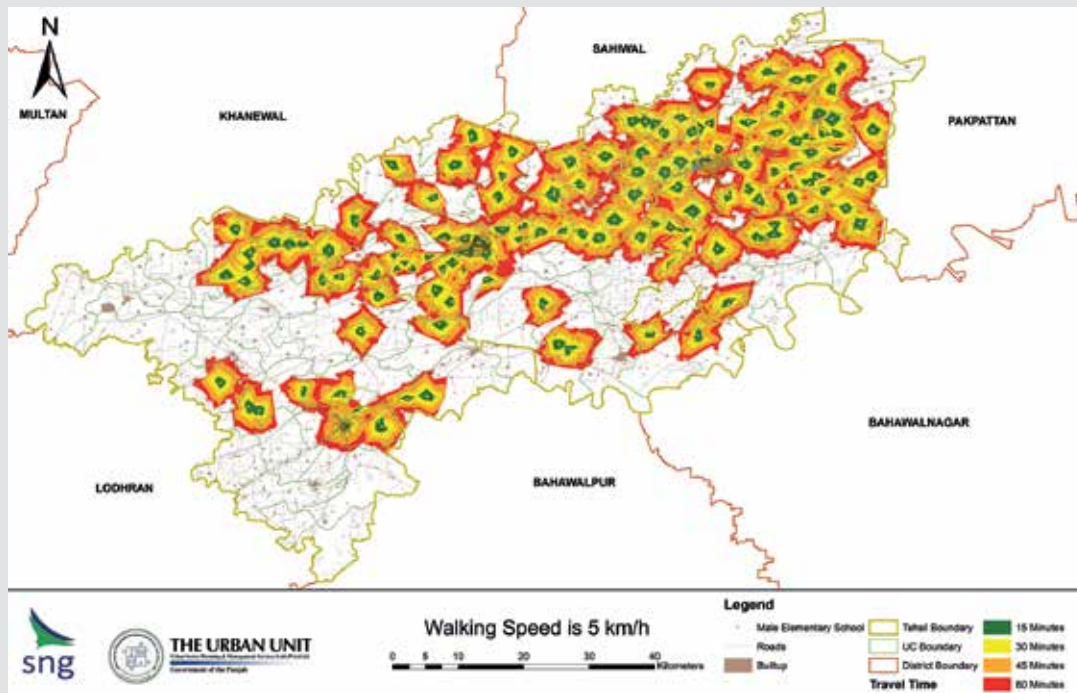
The local governments' capacity to deliver services has also been enhanced. During local bodies' elections in the province, GIS cells have proved exceptionally helpful in marking electoral boundaries. Additionally, maps have allowed for the demarcation of the jurisdictions of police stations, allowing Station House Officers (SHOs) to monitor areas in their jurisdiction and removing the difficulty for the public in reporting crimes.

Encouraged by the uptake of GIS in pilot districts, SNG Programme Punjab intends to use the case studies that have been generated in these districts to educate service delivery managers in other districts about the potential and capabilities of the GIS technology.

2 Source: Reconciled monthly statement of collection of CVT in Sheikhpura, 2014 & 2015

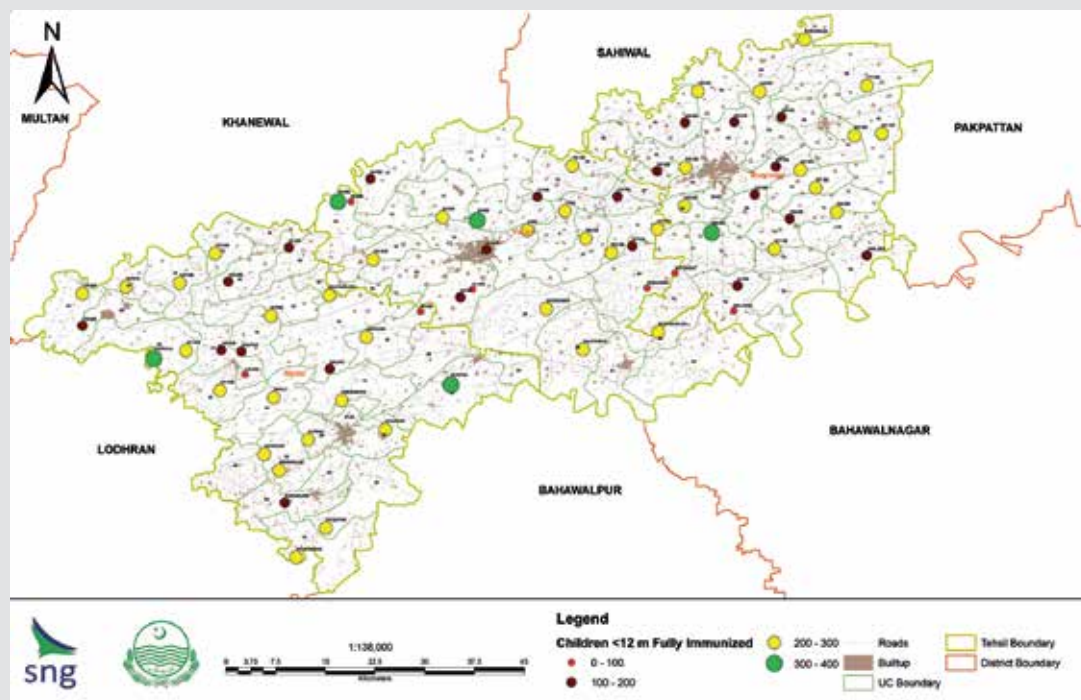


Figure 2: Travel time on-foot to Girls' Elementary Schools, Vehari



The green, yellow, orange and red colours around schools show the travel time for pedestrians. The red circles represent a travel time of above 45 minutes and white gaps between schools show travel time of more than 60 minutes. This information is crucial for decision-making on such issues as equitable budgetary allocations for the construction of new schools. A similar map for the health sector indicates the distance to the nearest health facility for pedestrians.

Figure 3: Fully immunised children < 12 months (November to January 2015); health facilities, Vehari



Those areas where interventions are urgently required in order to improve health indicators, in this case low numbers of immunised children, have become easily identifiable through the use of GIS technology.

Figure 4: Site found to be unsuitable for the Coal Power Project



The requirement for a coal fired power plant is that it must be near a water body, railway track and power transmission line. After spatial analysis of the above site, it was found unsuitable for the construction of power plant.

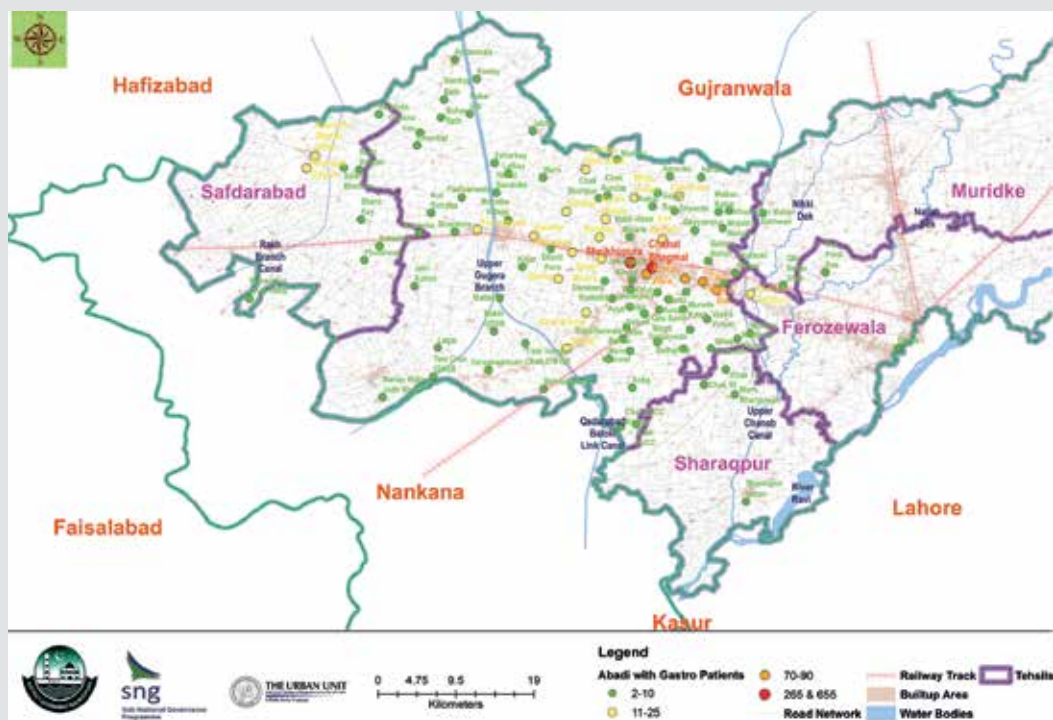
Figure 5: Suitable site for the 150 MW Coal Power Project, Mehta Suja, Sheikhpura plant.



The identification of a suitable site for the setting up of a coal fired power plant in Sheikhpura was made possible through GIS mapping. The site recommended by the GIS cell fulfilled all the prerequisites for the proposed plant and saved time traditionally spent on site visits.

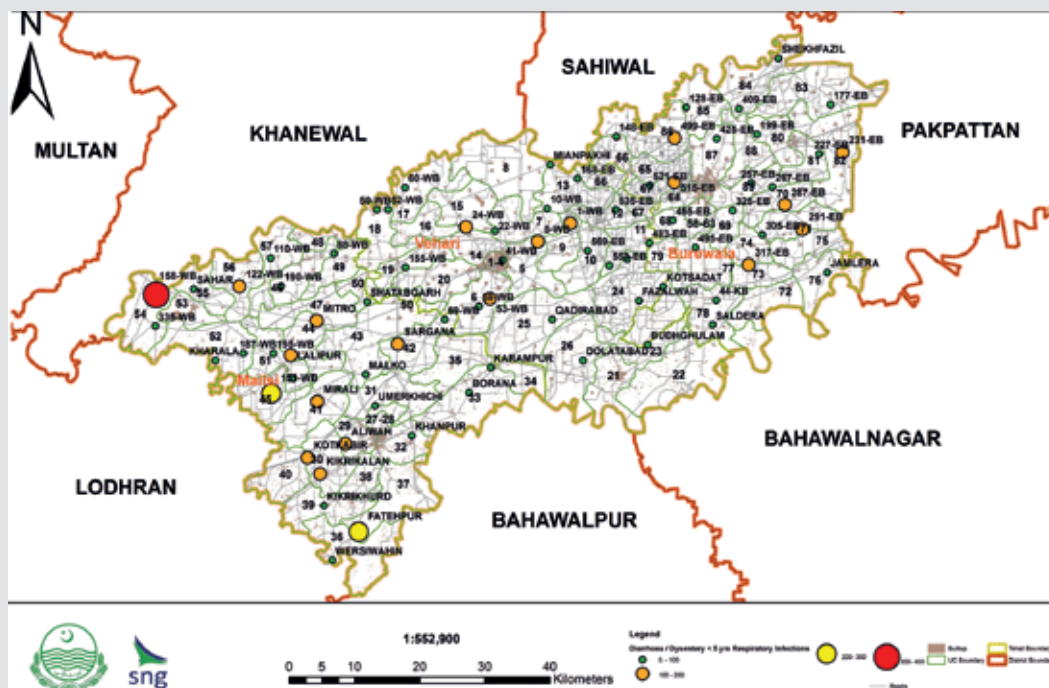


Figure 6: Gastro patients reported between 16 and 22 June, 2015 at DHQ Hospital, Sheikhpura



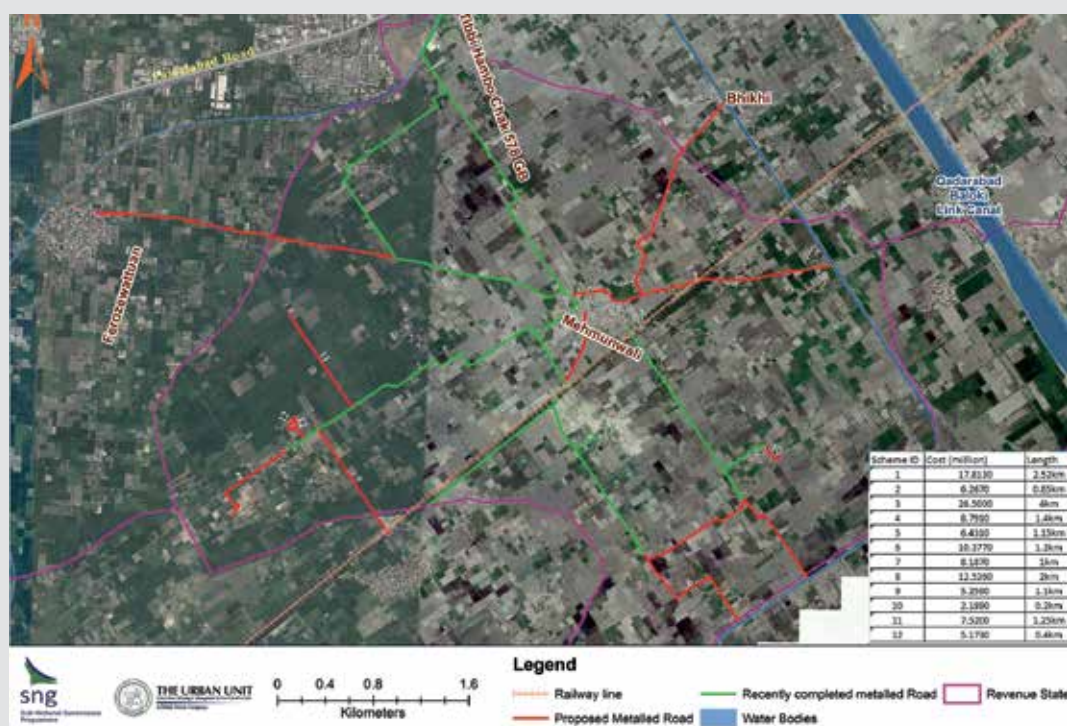
The gastro patients in settlements marked with red far exceeded those in other areas. This led to an inquiry by the district administration into the cause of this anomaly. The identification of intermixing of potable and sewage water as the cause enabled the district administration to address the issue to avoid further contamination.

Figure 7: Disease pattern for diarrhoea/dysentery in children < 5 years, health facilities, Vehari



Spatial analysis helped identify a localised outbreak of diarrhoea, which otherwise would have gone unnoticed and spread to other areas. Necessary resources were deployed and effective measures taken to control the outbreak.

Figure 8: Proposed development scheme (metalled roads), Sheikhpura



The proposed development schemes involving building metalled roads (coloured red), were evaluated for the DCO by the GIS Cell. The analysis indicated that some of the proposed metalled roads were not feasible. Roads not connecting populated areas were identified, preventing wastage of public money.

GIS is very useful for governance-related decision-making needs at the district level.

Here is why:

- It takes little time and few resources to integrate existing data from various sources.
- It is adaptable and can be used to store a wide range of information.
- GIS has an extensive scope for cross tabulation and for working out correlations between different variables.
- It is an effective monitoring and diagnostic tool, making the identification of gaps in service delivery cost effective and simple.
- It is an important planning tool and can be used for evidence-based and judicious allocation of resources.

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