

Chapter 4

Implementation Challenges for Establishing Smart Urban Information and Knowledge Management System

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Abstract In the present knowledge and information age, Indian towns are expanding rapidly in spatial and demographic terms. Moreover, spatial information are not correlated with the complex urban integrated problems, as data generated at various levels for urban planning remains uncoordinated and redundant to support decision-making and leading to poor urban governance. Hence, there is an urgent need to create common platform so as to address problems and issues in the right perspective to assist cities in coping with economic realities and, thereby, produce high-quality responsive environment and demonstrate successful urban solutions. Thus, in order to address these issues in a holistic manner, the Ministry of Urban Development has launched the National Urban Information System (NUIS) Scheme. The implementation of the NUIS Scheme would ultimately lead to e-Governance. In this context, the present paper is an attempt to address the various challenges like enhancing organizational capacity; cooperation between various stakeholders, accessibility of data, capacity building; and standardization of data format for the implementation of the Urban Information and Knowledge Management (UIKM) system in India. To establish the Digital Urban Information System in India is not simply a challenge but a mission to foster the mind of town planners and urban managers to tackle the real world problems only after analyzing the virtual world situations. Moreover, this paper also discusses that how establishment of effective efficient information system will pave the way for development of smart cities in India.

Keywords Urban information system • GIS • Spatial data base • e-Governance • Knowledge management

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Acronyms

DOS	Department of space
GIS	Geographic information system
GPR	Ground penetrating radar
HW	Hardware
ICT	Information and communication technology
MOUD	Ministry of Urban Development
MOU	Memorandum of understanding
NIC	National Informative Centre
NRSC	National Remote Sensing Centre
NSC	NUIS Scheme Standards Committee
NUDB&I	National Urban Databank and Indicators
NUIS	National Urban Information System
SCC	State Coordination Committee
SNA	State Nodal Agency
SNUIS	Smart National Urban Information System
SOI	Survey of India
SW	Software
TAC	Technical Advisory Committee
TCPO	Town and Country Planning Organization
UIKM	Urban Information and Knowledge Management
ULBs	Urban Local Bodies
USIS	Urban Spatial Information System

4.1 Introduction

Indian towns and cities have expanded rapidly in spatial and demographic terms as increasing numbers migrate to towns and cities in search of economic opportunities. Slums now account for one-fourth of all urban housing. In Mumbai, more than half the population live in slums, many of which are situated near employment centers in the heart of town, unlike in most of the other cities in developing countries. Urbanization is not a side effect of economic growth; it is an integral part of the process. As in most countries, in India also, urban areas make a major contribution to the country's economy. Although less than one-third of India's people live in cities and towns, these areas generate over two-third of the country's GDP and account for 90% of government revenue. Meeting the needs of India's soaring urban populations will continue to be a strategic policy matter. Critical issues that need to be addressed are:

- Poor or lack of participatory governance.
- Weak finances of Urban Local Bodies (ULBs) leading to inadequate or low level of developmental spatial or social planning.

- Delay in implementation of Master/Development plans leads to controlling the housing market by private developers and escalating the cost of housing and thereby living standards.
- Population pressure leads to critical infrastructure shortages and major service deficiencies that include erratic water and power supply and inadequate transportation systems.
- Deteriorating quality of environment indirectly leading to increase in social costs.

Moreover, planning activities involving spatial databases are not correlated with the sectoral/departmental data generated and as a result, the data generated at various levels for urban planning and management remains uncoordinated and redundant to support decision-making and leading to poor governance. Good governance is a necessary prerequisite for accelerated development and poverty reduction (Fig. 4.1).

There is need to tread common ground so as to address problems and issues in the right perspective to assist cities in coping with economic realities and thereby produce high quality responsive environment and demonstrate successful urban solutions. Thus, an effective plan implementation strategy needs to be evolved to achieve the following objectives:

- Timely implementation of Master Plans for guiding the growth of cities in the right perspective.
- Use of modern technology for urban management.
- Introduction of e-Governance.
- Establishment of Urban Information System.

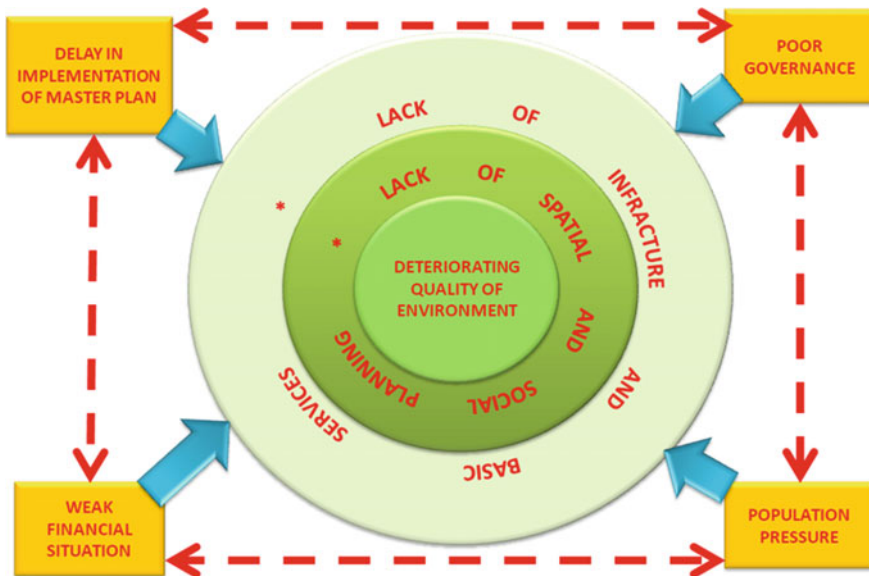


Fig. 4.1 Cause and effect of Urban area problems before the implementation of NUIS scheme

- e. Enhancing the financial capacities of ULBs.
- f. Protection of natural environment.
- g. Conservation of sensitive areas and built heritage.
- h. Optimize land use and land utilization.
- i. Provide services and adequate infrastructure.
- j. Ensure people participatory approach for supply of land and infrastructure development.
- k. Sustainable development of urban areas.

The efficiency of an urban area largely depends upon how well functionally and spatially it is planned; how economically it is developed and how efficiently it is managed? Local spatial planning inputs should largely govern the efficiency level of Indian towns and cities. At present Urban Local Bodies (ULBs) in India are responsible for providing and maintaining infrastructure and services in the towns/cities. However, due to continuously being under fiscal stress, ULBs are not in the position to maintain or create basic urban facilities. In spite of continuous efforts by Government of India through various schemes, there has been little or no increase in their revenue bases; user charges continue to be low or nonexistent. Faced with such a situation the ULBs barring a few exceptions are increasingly dependent on the State and Central Government Scheme for their operation and maintenance requirements. What is worse, many ULBs have accumulated 'large' debts and face serious problems in servicing them. Besides the restriction to a small resource base, poor information system and records management are some of the basic weaknesses in the present system.

Thus, in order to address these issues in a holistic manner, the Ministry of Urban Development has launched the National Urban Information System (NUIS) Scheme, on a pilot basis, during the Tenth Five Year Plan to develop GIS databases for 157 towns/cities in the country in two scales, i.e., 1:10000 and 1:2000. In addition, utility mapping on 1:1000 scale will also be undertaken for 24 towns. The spatial and attribute database thus generated will be useful for preparation of Master/Development Plans, detailed Town Planning Schemes and serve as decision support system. The implementation of the NUIS Scheme will ultimately lead to e-Governance at all hierarchical levels (Centre, State and Urban Local Body). But before this Scheme leads to e-Governance there are many challenges to tackle. In this context, this paper is an attempt to address the challenges for the implementation of the NUIS Scheme.

Before discussing the operational challenges, it is necessary to understand the issues confronting the urban areas in India.

a. **Planning**

- Many urban local bodies lack an updated planning framework;
- The multiplicity of Urban Authorities leads to problems in implementation of land use proposals; and
- Rigid master plans norms and restrictive zoning regulations limit cities' abilities to grow in accordance with changing needs.

b. **Housing**

- Building regulations not in accordance with urban density and floor space index—reduce the availability of houses and thereby pushing up property prices;
- Poor access to micro-finance thereby limiting the ability to buy or improve home demand;
- Policy, planning, and regulation deficiencies lead to a proliferation of slums; and
- Weak finances of urban local bodies and service providers.

c. **Service delivery**

- Most services are delivered by parastatals with unclear lines of accountability and inhibited transparency;
- There is a strong bias toward adding physical infrastructure rather than providing financially and environmentally sustainable services;
- Service providers are unable to recover operation and maintenance costs and depend on the government for finances; and
- Inabilities of Regulatory authorities to set tariffs, decide on subsidies, and enforce service quality checks.

d. **Infrastructure**

- Most urban local bodies do not generate the revenues needed to renew infrastructure, nor do they have the credit worthiness to access capital markets for funds; and
- Urban transport planning needs to be integrated with land use.

e. **Environment**

- The deteriorating urban environment is diminishing the physical quality of life of people at large.

f. **Governance**

- Lack of informed choices;
- Limited or no participatory approach;
- Lack of accountability and transparency in policy matters by implementing authorities;
- Lack of Public Private Partnership (PPP); and
- Poor information system and records management.

The focal point of these issues is basically lack of a single, accurate, shared spatial urban databases and this had created barrier for uniform spatial understanding, interacting, and providing the sustainable solution across. A major problem across the board in application of methods and procedures in urban

planning, plan monitoring/implementation and governance has been use of rigid conventional systems varying between various agencies and States with little scope to adapt to the demands of dynamic situations. Moreover, in view of availability of modern, efficient data sources and developments in Information and Communication Technology (ICT), and governance, ULBs are unable to optimally utilize the existing technologies in the face of highly varying data classifications, accuracies, scales, data format, etc., and lack of common databases. Therefore, it is a prerequisite that the systems and procedures be standardized at a national level and also integrated with the databases at various levels starting from sub-settlement (Urban/Rural) upwards to district/state/interstate regions/Nation.

In order to develop uniform urban databases, National Urban Information System Scheme was launched and will lead to effective e-Governance at all hierarchical levels (Centre, State and Urban Local Body). Besides, this NUIS Scheme is also developing image, thematic mapping, GIS databases, data exchange formats, protocols, communication equipment, software, and metadata standards which are important not only to facilitate data sharing and increase interoperability but also in development of customized application for planning, monitoring, and governance functions.

The basic aim of the NUIS Scheme is to develop comprehensive, seamless spatial and attribute databases with major objectives as to (a) Develop digital attribute as well as spatial information base for various levels of urban planning, (b) Use modern data sources like Satellite and Aerial platforms, (c) Develop Standards (d) Develop urban indices, and (e) Build Capacity. Structurally NUIS Scheme comprises of two components (a) Urban Spatial Information System (USIS) to meet the spatial requirements of urban planning (b) National Urban Databank and Indicators (NUDB&I) to develop town-level urban database.

National Urban Information System (NUIS) is a dynamic, hierarchy, and multidisciplinary concept that includes institutional, policy, technical, standards, and human resources dimensions and will provide facilitation and coordination of the exchange and sharing of spatial data between stakeholders at different jurisdictional levels. They have become very important in determining the way in which spatial data is used for local, state and national development and contribute to economic growth, environmental quality and stability and social progress.

4.2 Challenges Ahead

Demand for framework data as opposed to topographic maps is rising, and users increasingly expect data that is tailored to particular needs. The users specify what they want and when and how they wish to receive it. They want easy access to customized data and solutions that offer efficiency savings and value for their money. Tremendous challenges in harnessing technology exist especially in parts of the world where there is little capital available for investment.

In the world beyond the map paradigm, users no longer want maps and they want personalized data. There is need to champion new technologies and

methodologies impacting on the handling of geospatial data and adopt more customer-focused approaches to their products and services.

Nodal agencies at the center, i.e., Town and Country Planning Organization (TCPO) recognize that they have a multifaceted role, serving the needs of government and ultimately citizens at large. They seek to proactively coordinated geospatial activity and make information widely accessible, nationally consistent and well maintained.

The needs of local, state governments often remain unattended as traditionally they are controlled elsewhere. Thus in future, state government and local government should focus on the needs of customers in all sectors, whether that means government at all level or private business. So there is need to maintain an excellent working relationship with local (ULBs) State Governments helping both to share the benefits of consistent, national geographical framework and policies. Spatial data is pervasively available from many sources in today's world.

The National Urban Information System Scheme is tailored to the need of local and State Government requirement. Two national level workshops at New Delhi and Bangalore were organized and concept of Urban Information System was discussed to give maximum exposure to the town planners and State Government officers. Apart from these, two Regional Workshops at Chennai and Shimla were organized in a small group of 8–10 States and by listing all the implementation problems and the possible solution were guided (Fig. 4.2). Thus, by utilizing the



Fig. 4.2 Stakeholder problem tree analysis in regional workshop held at Shimla under NUIS scheme

local knowledge and information problem tree solutions to each specific problem were tackled and arrived at. Individual training programme at State level with networking institutions were held giving benefit to the participants by incorporating different levels of the training programme. Thus the approach is participatory, transparent and inclusive by allowing ULBs to choose the level for skill building and knowledge upgradation.

4.3 Challenges to Enhance Organizational Capacity

In order to enhance the organizational capabilities of stakeholders' State Town Planning Departments, have to adopt a new business and technological regimes in order to guarantee collection and maintenance of geospatial data. The business strategy should be determined through the scope of business in terms of pricing, content, and quality of spatial data, policies of governance, strategies for distribution, scope of value added services, process for geospatial data production and infrastructure available with stakeholders. The strategy to adopt technology should be focused on the appropriate information technology system and capabilities available in the current market in terms of reliability, flexibility, and interconnectivity of the system.

4.4 Local and National Challenges for Implementation of NUIS Scheme

The current complexity of communications between the various local and national bodies in the vast country like India is very high. For the purpose of data sharing, organizations in different states and at center should be bound with agreement with each and every other user within the country for sharing geospatial data. However, this complexity can be reduced by developing NUIS Scheme with the cooperation of different States and Centre Governments. The implementation of NUIS Scheme will form a fundamental framework to exchange data across the country.

NUIS can provide the institutional, political, and technical basis to ensure the center and state consistency of content to meet local needs in the context of sustainable development. Within this, the fundamental data sets can be collected and maintained through partnerships. There data sets will include all data necessary to understand both spatial and nonspatial forms.

To ensure an optimum advantage of the NUIS Scheme and to speed up its development, the following factors are required to be considered.

- i. Awareness of NUIS Scheme concept and vision;
- ii. Cooperation between the various stakeholders;
- iii. Knowledge about the type, location, quality and ownership of data;

- iv. Accessibility of data sets; and
- v. The successful widespread use of the data sets.

The spatial data stakeholders (data providers, value adders and data users), State governments, and technical people should be made aware of the potential and advantages of spatial information technologies. Knowledge about the types of data, its location, and quality is also important. It is also important to provide access of the data to its users for success. The success is dependent on legal and technical issues, to provide an effective communication channel between all stakeholders which permits easy access, simply, quickly, securely and at low cost. However, if the resources are not available to keep the NUIS up to date then there is little justification for its development. Therefore, funding and resources to secure the implementation is always an important issue.

There are large amounts of digital data with many common data layers available at different scales in different organizations, at state and center level that could be useful for the creation and facilitation of NUIS initiatives. There are also some other factors which influence the progress of NUIS Scheme which make it difficult to prepare an environment for implementation, i.e., awareness of the potential usefulness, Social and cultural diversities, languages, and so forth.

4.5 Challenges for Generation of Spatial Databases Under NUIS Scheme

4.5.1 The Dilemma of Inconsistent Mapping

State Government, ULBs and government mapping agencies [like Town and Country Planning Organization (TCPO), National Remote Sensing Centre (NRSC), Survey of India (SOI)] over a period of time developed their own mapping databases content, formats, software, to support their requirement and need. The colossal tasks before the NUIS Scheme are to create the common platform to interact these agencies. What is missing in a way to leverage the information from these collective investments is to create an accurate and current database with rich geospatial enhancements and with collaboration across agencies, while each continues to serve its individual, unique needs. As a result, NUIS Scheme Standards Committee (NSC) was constituted on June 12, 2002 by the Ministry of Urban Development at the center when the Scheme was at conceptual level. When the NUIS Scheme was launched in March, 2006, Technical Advisory Committee was constituted under the chairmanship of Joint Secretary (Urban Development) with members from SOI, National Informative Centre (NIC), Department of Space (DOS), NRSC and States Governments for the following objectives:

- To recommend technologies and methodologies to be applied in the NUIS Scheme;

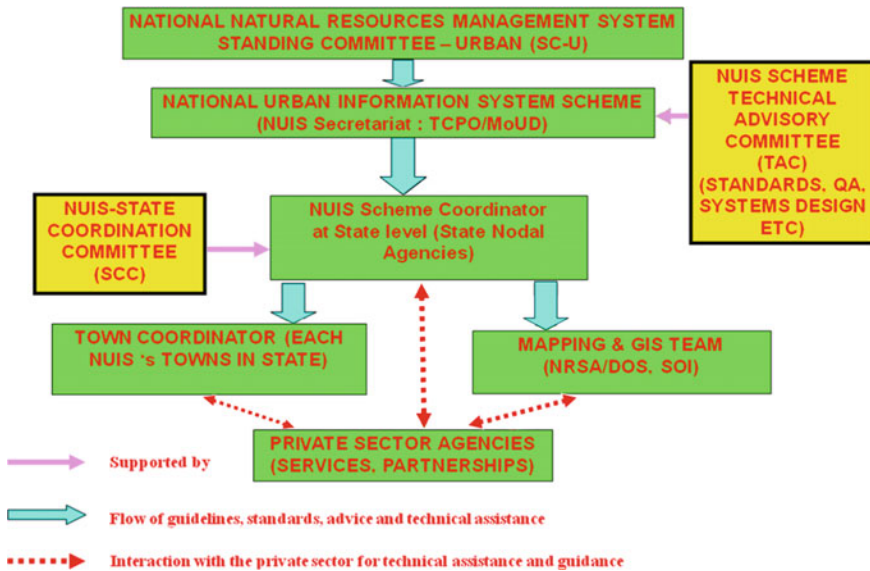


Fig. 4.3 The challenges for generation of spatial and attribute databases

- Evaluate and approve the NUIS Scheme Standards documents;
- Evaluate and recommend cost effective solutions;
- Evaluate and approve Hardware and software solutions for procurement;
- Evaluate technical specifications and capabilities for contracting the NUIS Scheme jobs;
- Evaluate and direct/channelized the application development;
- Evaluate and approve the strategies for capacity building in terms of identification of training institutions and curriculum for training at various levels for NUIS Scheme town officials; and
- Review and suggest modifications in the methodologies in database- development in view of changing technologies as well as the lessons learnt.

At the State Level, State Coordination Committee (SCC), were constituted in 33 States (including the Union Territories) to share the common platform in the State to not only for implementation of NUIS Scheme but also to give common ground to Urban development Agencies to discuss strategies for urban development in holistic mode (Fig. 4.3).

4.5.2 Creating and Upholding a Statement of Quality that is Measurable

Quality begins with compiling as much data as possible from only the most reliable sources, including Satellite and Aerial platforms; public data sources; government and other available public or private sources. Because change is constant, compilation must be performed on an ongoing basis, and is critical to maintaining uninterrupted access and ensuring direct data feeds from these sources updated daily or as often as needed to support the freshest, richest, most accurate data available. However, it is not enough to simply compile data and constantly update changes. Full data comprehension is also the need of the hour besides recent advances in data accuracy—including methodologies that supplement the act of compiling thereby enhancing the precision of spatial data information.

In addition, advances in dataset richness like point-addressing are bringing razor-sharp precision to locational information. These developments translate into unparalleled levels of accuracy and quality for digital mapping data. The mission-critical nature and far-reaching scope of operations demand a second important element.

A plan for maintaining consistent data quality is that a single mapping database must be configurable to support the specific database content and quality requirements demanded by the agency or state in question. By working with digital mapping providers, governments can define requisite database content and quality standards, as well as the manner by which government data will be maintained, in order to keep critical information up to date and leverage investments in mapping data. In other words, a single mapping database should maintain strong, robust connectivity to existing data and systems.

4.5.3 Interagency Collaboration

Uniform spatial understanding and communication—enabled through a single map database—is an important and necessary first step.

- A clear and complete vision and plan to improve processes both within Stakeholders and partners to take advantage of the new data sources.
- Robust information System to collect, filter, manage, and analyze the data, and turn it into valuable, actionable source of information.
- Powerful, distributed server infrastructure scales cost effectively to support rising demands. Additional processing power is needed at the edge to filter and consolidate tagged data; in the middle tier to run new, applications; and on the back end to handle expanded database requirements.
- Wireless networking infrastructure and high-performance Computing and communications solutions.

- A common understanding of the objective by the stakeholders and uploading and implementation.

4.6 Success Story

As the scheme involves application of modern automated methods for map preparation, like Aerial Photos, Satellite Images and Ground Penetrating Radar (GPR) and Geographic Information System (GIS), one of the important challenges for implementation of NUIS Scheme is the availability of trained manpower in towns and States. For this NUIS Guidelines envisages, the capacity building programme at 3 levels, i.e., Operators or Technicians/Working level, Supervisory level and Decision-Makers level. For effective implementation of NUIS Scheme in 157 towns, about 600 personnel would have to be trained in about 30 training programmes with 20 participants per programme. During the financial year 2006–07, 160 personal from State and ULBs have been trained in eight training programmes and during the financial year 2007–08, a series of training programmes had been completed and over 600 personal have been trained till now.

4.6.1 Milestones Achieved Under NUIS Scheme

- i. A **Memorandum of Understanding (MOU)** has been signed between MOUD and the National Mapping Agency, Survey of India (SOI) for data generation on March 13, 2006.
- ii. **NUIS Scheme Guidelines** has been prepared and circulated in both soft and hard copies to all State Governments and also uploaded on the Ministry's website.
- iii. A **Proforma** for collection of **attribute data of NUDB&I** has been prepared and circulated to all State Governments and SNAs and also uploaded on the Ministry's website.
- iv. **NUIS Design and Standards document** has been approved by the Ministry and circulated to all the State Governments, DOS, SOI and up loaded on the Ministry's website.
- v. Efforts have been made to seek **release of State Share, demarcation of town areas, identification of State Nodal Agency (SNA)** and constitution of State Coordination Committee (SCC).
- vi. **Road Map of NUIS Scheme** has been approved by the Ministry and circulated to all the State Governments and up loaded on the Ministry's website.

- i. **Capacity Building:** Capacity Building programme reached at advanced level covering all the 35 States and UT's building skills of nearly 600 town planners/town planning professional by organizing more than 38 training programme since inception (March, 2006). Exposure is given on the basics of Remote Sensing and Aerial photos, Ground Penetrating Radar (GPR) interpretation, image analysis, and manipulation in GIS environment.
- ii. The **HW/SW configuration** for Central, State and ULBs has been finalized. Through the efforts of TCPO, State Governments had released respective State share for procurement of HW/SW and Central Share are also released for the same.
- iii. **NUIS Scheme Cell** has been established at Centre/State/ULBs level.
- iv. A platform [Technical Advisory Committee (TAC) at the Centre and State Coordination Committee (SCC) at State Level] has been set up between Stakeholders toward a common concerned and understanding.

4.7 NUIS Scheme as a Basis of Smart City Development

In future, NUIS Scheme will pave the way for establishment of Smart NUIS (SNUIS) Scheme by linking smart citizen oriented services for use of digital information generation through Web 2.0 technologies. The provision of basic infrastructure; environmental impact assessment; planning, and building permission; traffic and transportation management and successful implementation of Master/Zonal Plans are some of the areas which need to be managed by GIS and Web 2.0 software for easy access to the masses. Moreover establishment of Smart NUIS Scheme will give local urban community free hand to tailored or customized GIS and Web 2.0 technologies as per their need and requirement and generate or manipulate their own information or spatial data rather than given answer or raised query to the predefined proposed land use map. Hence, Smart NUIS with the help of GIS and Web 2.0 technology is an inclusive, smart, and sustainable Scheme to build our cities smart (Fig. 4.4).

4.8 Conclusion

The state-of-the-art global communication technologies and thriving economy is facilitating Indian cities to compete in the global environment. The constant transformation of urban areas into complex entities has brought forth new challenges and opportunities for Planners to design and implement a variety of activities in spatial terms. There is need to tread common ground so as to address problems and issues in the right perspective to assist cities in coping with economic realities and thereby produce high quality responsive environment and demonstrate

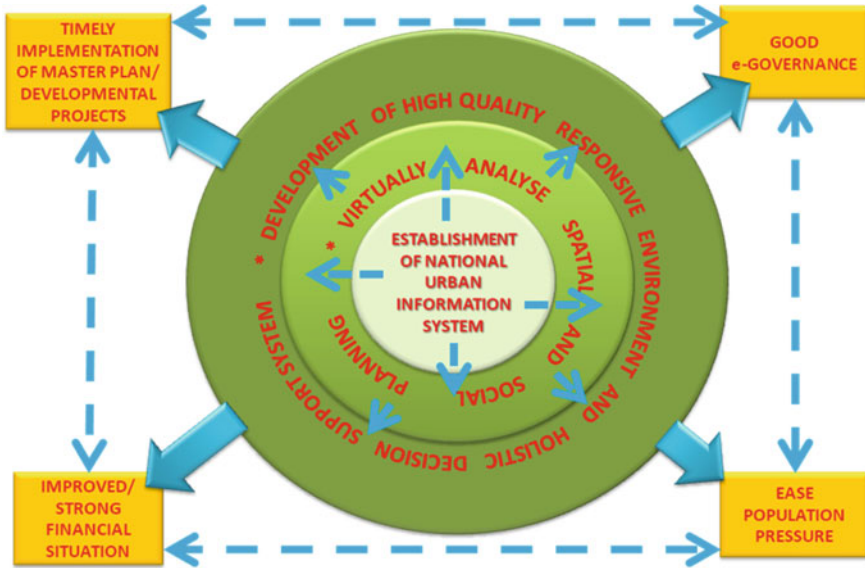


Fig. 4.4 Cause and effect relationship after the establishment and implementation of NUIS

successful urban solutions. The spatial and attribute database thus generated under the NUIS Scheme will be useful for preparation of Master/Development Plans, detailed town planning schemes and serve as decision support. This paper has described the experiences and challenges faced during the process of implementation of NUIS Scheme. To establish the Digital Urban Information System in India is not simply a challenge but a mission to foster the mind of town planners and urban managers to tackle the real word problems after analyzing the virtual world situations and to build smart and responsive city.

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