

# Components for Planning Future Smart Hill Cities, Case Study Shimla (India)

Ritu S Mehrotra

Senior Urban Planner and Former Urban Planning Consultant-Team Leader, UNDP

**Abstract:** *Globally the expression of smart city has been correlated to approaches such as “sustainable city”, “resilient city”, “liveable city”, “green city”, “playable city”, “healthy city”, “eco-city” and so forth. The future sustainability of cities necessitates use of innovative technologies for building intelligent infrastructure and optimum utilisation of resources in more intricate urban systems. Hill cities are ever more complex with additional topographical conditions and climatic conditions which require a more advanced technological input and meticulous planning efforts in fragile ecosystems. Shimla, like other hill cities, began with a maximum population of 25,000-30,000, has over the time undergone continuous increase in urban population, unplanned - unregulated growth which has resulted in environmental degradation and pressure on existing resources and infrastructural services. The paper highlights urban development issues and present possible planning strategies to develop the Shimla city and its region, as an illustration for hill cities, towards sustainability by adoption of new technologies suitable to local conditions.*

**Keywords:** Topography, Sustainable, hill cities, smart city, urban growth, environment, infrastructure, connectivity, region, challenges, resilient

## 1. Introduction

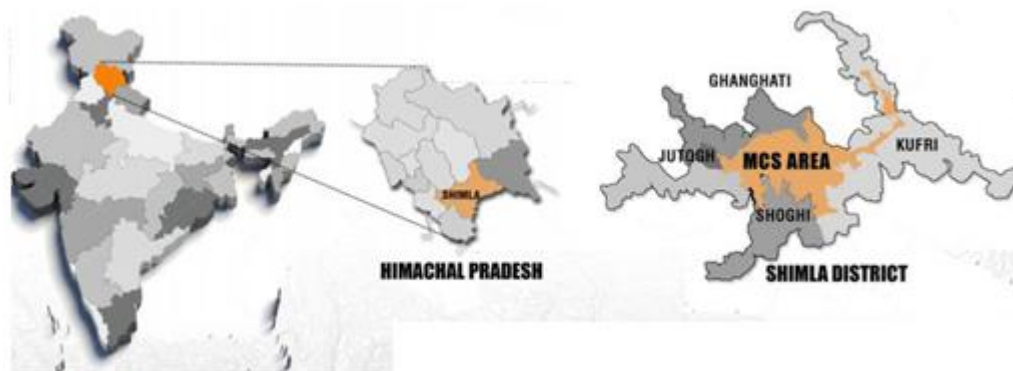
Smart city has become most popular formulation for the future cities. The cities equipped with good infrastructure in developed nations, for them, the focus is primarily on asset optimization, operations monitoring, data communications and analytics with the objective of transition to a low carbon economy. Whereas, in developing countries, such as India, cities have experienced growth in urban population due to migration which has put immense pressure on existing physical and social infrastructure including land. Managing urban growth in Indian cities need more comprehensive approach in their planning system with the possible application of Information and Communication Technology (ICT).

Indian hill cities due to their difficult topography, complex geological structure, adverse climatic condition and fragile ecology has faced various challenges with respect to their development. Majority of these hill towns in country are prominent tourist destinations. The hill cities in India, especially Shimla (capital of Himachal Pradesh) which has been taken as a case study are facing challenges of inadequate and obsolete infrastructure, environmental degradation, energy crisis, employment creation, in a very eco-sensitive and physically constrained context. In such a scenario building modern infrastructure that are scalable, intelligent and interoperable becomes important. Developing

Shimla city with intelligent and sustainable policies has been amongst the biggest challenges, considering the past unplanned interventions. This paper focuses on urban development and environment challenges for Shimla city and present strategies to overcome these issues and problems including smart growth.

## 2. Overview

The city of Shimla which is presently the capital of Himachal Pradesh State was established as an administrative and capital town of India during the British rule. The city is situated on the last traverse spur of the Central Himalayas, south of the river Satluj at 31°04' north to 31°10' North latitude and 77°05' east to 77°15' longitude, at an altitude of 2130 metres above mean sea level. The city is a unique combination of hills, contours, elevation and spurs of Shimla city spurs and valleys. It is spread over seven hill spurs, namely, Jakhoo Hill, Elysium Hill, Museum Hill, Prospect Hill, Observatory Hill, Summer Hill and Potters Hill. These spurs are interconnected by roads. The city is connected to national capital of India- Delhi and city of Chandigarh and Kalka through National Highway (NH) 44, NH 152 and NH 5. The city has railway access through a narrow gauge line, connecting Shimla with Kalka town. The city airport is located at a distance of 23 km from the main city.



**Figure 1:** Map showing Location Himachal Pradesh state, Shimla District and Shimla city  
Source: Smart City Proposal, Municipal Corporation Shimla, 2017

The present city of Shimla was designed for the population of 25000, which comprised of low rise, low density development made of cottages for European and Indian elite including commercial and social facilities. The city after independence attracted population from other districts and surrounding regions due to concentration of employment and economic activities. With its establishment as a state capital, the city became a predominant hub of administrative, cultural, educational, health and tourist activities experiencing growth exponentially. The city has total area of 35.34 sqkm which is governed by Municipal Corporation of Shimla. Total population of city during the year 2011 was 1,69,758 and 1,42,555 in the year 2001. The decadal population growth for year 2001-2011 was 19% which was 32% for the year 1991-2001. Population density of city for year 2011 was 47.7 person per hectare which was 40.63 person per hectare during 2001. However the growth of population was estimated to be increased to 1.98 lakhs for the year 2019. The average literacy rate of Shimla city is 94.67%, of which male and female literacy rate is 95.75% and 93.35%, respectively, (Source Census 2011).

As per the development plan of Shimla, the area extending beyond the Municipal limits is part of Shimla Urban area also known as Shimla Development Area<sup>1</sup> (SDA). The total population of SDA was 2,04,758 in year 2011, and it comprised an area of 99.5 sq. km.

The city contributes largest share to the state's GDP. 92% of city workforce is engaged in tertiary activities. Tourism industry is the largest employer of the city population. The city possesses distinct character and physical environment with pleasant climate, which attracts tourists from all around the world. The city experiences a floating population of 81,000 per day. The city is divided into six heritage zone boasting 92 heritage buildings of colonial period. Kalka Shimla railway line is an UNESCO world heritage site which is one of prominent tourist attraction.

<sup>1</sup>Shimla Development area comprises urban area of Shimla and three special areas of Kufri, Shoghi and Ghannati, covering total area of 99.5 sq km. Total 127 villages are part of Shimla Development area also known as Shimla Planning Area.

### 3. Problems and Existing Challenges

The city confronted with record nuances of continuous urban development which can be attributed to the fact that the city was earlier designed for little population has grown multifold. The massive growth of city of in form of unplanned ribbon development towards south, east and west direction has resulted in huge urban sprawl along the transportation corridors. The development pattern in city is governed by topographical constraints such as steep slopes, elongated hilly spurs, forest areas and zones of perpetual sunshades. Sunny slopes and spurs have become highly congested. Scarcity of land for development has resulted in shift from low rise structures to high-rise which is against hill development imperatives (Figure 3). Constraints in availability of land has also posed problems for infrastructure development such as roads, parking's, development of public spaces and parks. About 90 percent of the city is built on land not suitable for development. Structures are built on 60-degree slopes, although construction is prohibited on slopes above 45 degrees.



**Figure 2**



**Figure 3: High Rise Structures**

The uncontrolled haphazard physical growth of the hill city is creating problems at two levels- the damage to the nature resources; and the character and functionality loss of the urban form. The disturbance to the natural profile of land by cutting of terrain for constructions, roads, incompatible land uses, encroachment on forest lands, increasing depth of water table, construction of structures on natural drainage (nallas), along with land, water, air and noise pollution have grossly affected the sensitive eco-system of the region.

There is deterioration in quality of living due to over concentration of population in this small town primarily in the central area due to lack of enforcement of building regulations and absence of regulated planning mechanisms. Lack of accessibility to many structures and localities is a matter of serious concern. Increasing physical expansion of city has also led in lack of integration between place of work and place of living. The city has also undergone problems related to urban land use planning, control and regulations. Several amendments have been made for building regulations, Floor Area Ratio (FAR) and number of storeys and heritage buildings in Interim Development Plan for Shimla.

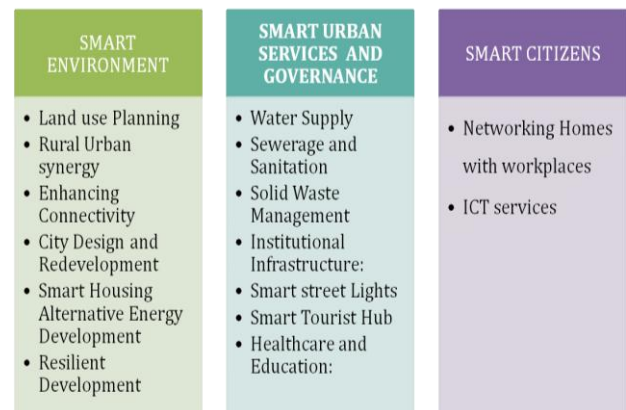
Shimla city being situated in Seismic Zone IV is highly vulnerable to natural hazards such as earthquakes, landslides, and sinking of land. Almost 25 percent of the total city is under sinking zone due to unregulated construction and increasing population, and poor sewerage and drainage system.

The crisis situation in the city can be attributed to- first, failure to develop a long term urban and regional planning policy and secondly to the apathy in implementing the existing planning and development norms. In the last two decades, the city has grown horizontally and vertically without any sensitivity to the urban form or to the natural environment. The chaotic situation is worsening with large exodus of population to Shimla and its immediate neighbouring settlements (peri-urban areas). Therefore, it is important to have a comprehensive approach to urban spatial development to preserve the original character of city and to make it a sustainable and technologically advanced city.

#### 4. Key Pillars for Smart City Growth

Smart city growth emphasise on city development through 'collaboration and cooperation' by taking advantage of the

possibilities enabled by information technology fostering optimum utilisation of resources. A smart city needs to enhance quality of life, boost economic competitiveness, and necessitate efficiency in infrastructure services whilst reducing environmental impacts. Shimla being a hill city needs a conscious prioritisation on, resilient urban environment, Smart urban services and governance and infrastructure development and citizen friendly.



**Figure 4: Components for Developing Smart City, Shimla**

##### 4.1 Smart Environment

The focus of Smart Environment entails overall optimization and conservation of natural resources through efficient urban planning, good connectivity and city design. As discussed, the city has undergone unparalleled physical transformation and lately, the last few years have also witnessed unusual climatic variations with increasing heat during summers, unusual and unpredictable monsoons with dry spells followed with decrease in snowfall. If "sustainable development" is to become the central theme of physical development policy a holistic approach shall be needed for applying the smart city concepts and technology. The following section discusses the pillars of smart environment and its relationship with built form.

- Land use Planning
- A synergy between Rural and Urban regions
- Enhancing Connectivity
- Urban Design, and Redevelopment
- Alternative Energy Development
- Resilient Development

#### 4.1.1 Land use Planning

The preparation of Land use plan in Shimla city is a mandate of Town and Country Planning Organisation (TCPO). TCPO is also responsible for ensuring planned and regulated development of Planning and Special Areas constituted under the provisions of Himachal Pradesh Town and Country Planning Act, 1977. The last Interim Development Plan for the city was prepared in 1979 and Draft Development Plan for city was prepared in 2012. There is an absence of Master Plan, which serves as a legal document for guided growth of city. Use of Geographical Information System (GIS) for creating Master Plan, local plan and zonal plans is essential for planned city growth. Looking at the present city and its peri-urban growth it is essential that city planning should also be viewed in the framework of regional plan. Developing new urban centres around city will not only reduce the pressure on city core but will also promote balanced city region development.

Developing a spatial database with multiple layers should be at priority for Shimla city and its region. The planning area of Shimla city which extends beyond the Municipal limits has about 61% of area under forests. The city presently is devoid of open spaces. Presently, the city land-use covers merely 0.41% of the total area under open spaces<sup>2</sup>. A zoned and designated percentage of land for green cover within the city by protecting city forests and green belt covers in the periphery of city should be part of the land use strategy. Developing the existing forest trails and paths can also be an opportune for providing good quality recreational spaces in city. Managing growing inequalities and environmental degradation is the paradigm shift necessary for sustainability of the city.

Development Strategy need a prioritisation on integrated land use- transport- environment planning framework for urban growth and conservation of rural, forest, areas of high landscape and environmental value.

#### 4.1.2 A synergy between Rural and Urban regions

The present urbanization process has witnessed unbalanced relationship between the city and its rural hinterland. The central parts or the Mall of the Shimla city will always continue to be the core of its urban fabric, whereas, the new special areas have potential to provide city with strategic long term solution with respect to space for housing, tourism, leisure and economic development. The benefits of the economic growth need to be socially and geographically inclusive for an environmentally friendly sustainable development.

Preserving and developing surrounding villages, agricultural areas and green belts around hill cities for future food sustainability- fresh fruits, vegetables as well as dairy and farm products is essential. These villages can be developed as growth centres for activities such as agriculture, horticulture and floriculture for the city and beyond.

City hinterlands are also sites for tourist activities and recreational facilities. The "Forest-landscape", "climate" and the "city-architecture" form the tripod of the tourism industry

and therefore their protection and conservation should be given maximum priority.

#### 4.1.3 Enhancing Connectivity

The road infrastructure in city was created to cater the needs of smaller population. Due to increasing number of personal vehicles on smaller roads and inadequate public transportation facilities, the existing city transportation network is becoming redundant. Congested road space has also resulted in prolonged traffic jams and decrease in pedestrian movements. Total number of vehicular registration in city per day is above 200.<sup>3</sup>

The city provides both horizontal and vertical movement. Horizontal movement in city is in form of roads and vertical movement through Public lifts and Ropeway. As per the City Mobility Plan 42% trips in city are made on foot. Public transport which is only in form of bus is used by 25% of people. The city faces issues related to traffic congestions due to increasing population and inadequate road widths. To improve the present situation of mobility, vertical mobility through lifts and escalators need to be enhanced at various places. Strengthening public transport services through various modes and promotion of alternatives modes of designed transport systems suitable for the hilly terrain need to be promoted. Ropeways are proposed as an alternative public transport mode in city, which will connect city core to the bus stand area and, secondly Jakhoo area to the city. Light rails like the one famous in Shimla, specially designed buses and world-class pedestrian routes shall not only enhance the character of such urban areas but also affect the tourism as well as contribute to green development. Provision of feeder transport and strengthening feeder networks is essential to increase linkages with rural and peri urban areas of city.

On street parking becomes a common phenomenon due to increasing floating population. The city has only 4,311 ECS parking available, while the demand is currently at 14,500 ECS parking. To address the parking issues and meet the present and future demand in city various parking projects have been proposed on PPP mode.

The city of Shimla is characterized as Walk-able city. There is need to promote and enhance pedestrian routes to promote walking and minimizing short vehicular travel. Developing well designed pedestrian arteries in city which are shortest and easiest mode of travel for short distances should be taken up to preserve the character and heritage of city.

A well thought-out spatial development strategy and transport network would be needed to promote a better synergy among the development nodes and axis to achieve agglomeration economies, optimize population and employment opportunities, and balance development and conservation needs.

#### 4.1.4 City Design and Redevelopment

A separate urban design framework with reference to the unique city form, climatic and environmental considerations, cultural, heritage and conservation, public space is needed to

<sup>2</sup>Draft Development Plan Shimla Planning Area, 2012

<sup>3</sup>Shimla City Mobility Plan, 2011

be enforced starting from the central core and the main urban area followed by the various development nodes in city region.

Due to scarcity of urban land majority of structures are unsafe and prone to hazards. Refining urban design framework having regard to unique city form, urban climatic considerations, cultural heritage, nature conservation, and public space development will complement the city by making it more liveable and sustainable compact city.

There is need for managing and regulating the construction activities in city and exploring opportunities through community efforts and integrated planning approach to redevelop areas of city for creating liveable environment. Redeveloping the increasingly unsafe central areas of the city such as Krishna Nagar (Ward No 11), Lower Bazaar Area (Ward No. 13), to name a few and focusing on city aesthetics should be the some of the initial steps for infusing smart infrastructure for the smart growth.

#### 4.1.5 Smart Housing and Alternative Energy Development

Smart initiatives will enhance provision of affordable housing to economically weaker sections of society and low income group with a strong focus on social inclusion. Diverse housing opportunities and meticulous planning and development in accordance with environmental and ecological imperatives of the city is required. The extension of "Corporate Social Responsibility" will encourage slum redevelopment and private sector participation to combat the issues of housing. The housing areas should also incorporate adequate fire safety equipment and refuse areas for firefighting & evacuation and security as per risk profile.

In planning new strategic growth areas it will be opportune to incorporate smart, green and resilient initiatives to make them more liveable. The initiatives can be in form of using cutting edge technology to reduce carbon emission, urban heat island effect, wider use of ICT for better planning, green transportation, land-use management, and enhancing city resilience. Sustainable infrastructure for efficient water supply (Reducing Unaccounted flow of water), waste minimization/collection recycling facilities including total water management and conservation.

The newer buildings should be in accordance to the building regulations for achieving higher standards of safety and living standard. Energy efficient buildings which are sensitive to the city and also incorporate state of art features like green roofs, solar panels should be part of the new housing strategy. Solar master plan for the city has been prepared by the Ministry of Renewable Energy. Solar passive building design is now mandatory in public/government buildings and has been incorporated in the Himachal Pradesh Town and Country Planning Rules, 2009.

#### 4.1.6 Resilient Development

Resilience is the ability to arise back after major natural, economic, social or manmade disasters or changes affect the functioning of the city. For a smart city, there is need for enhancing the resilient infrastructures as well as heightening

the public's awareness for vigilance and emergency preparedness within community.

Shimla city due to its location and geological features is exposed to various natural and human induced hazards. The state of Himachal falls in most active seismic zones i.e. Zone IV and Zone V. The city in recent past has experienced various earthquakes and landslides. To combat the risk of extreme weather events such as high rainfall, landslides, earthquakes, the city need to enhance resilience against the weather-related hazards. Minimizing human vulnerability by replacing dilapidated and unsafe building stock with new and earthquake resilient structures.

This includes improving both the "hardware" and "software" aspects of resilience. "Hardware" aspects include resilience through enhanced engineering approach to upgrade infrastructure, making it more robust in protecting from serious hazards. This encompasses the adoption of improved design standards and practice, as well as implementation of retrofitting and improvement works to upgrade facilities.

"Software" aspects of resilience includes setting up warning systems for the relevant hazards such as installing sensors for fire, landslides at certain sensitive zones, educating the public, providing emergency service in times of crisis to rescue and evacuate the population at risk, carrying out urgent repairs, implementing recovery initiatives.

## 4.2 Smart Urban Services and Governance

### 4.2.1 Water Supply

The present water yield in Shimla city is 52.84 MLD, as against the total demand of 34 MLD. However the water yield and supply varies from season to season due to availability of water at source and high Unaccounted Flow of Water (UFW). Currently, 70% of the city population is served by piped water connections with only 58% metered connections. However, with the provision of public taps in areas not served with private taps, it is envisaged that entire city is provided with water supply. The extent of non-revenue water is 45%. In such a scenario it is essential to have a sound water management strategy for provision of adequate quantity and quality. Smart meters and sensors integrated into pipes and pumps will facilitate timely maintenance and repairs to be carried out more quickly and efficiently and measures to be taken for managing demand, encouraging water conservation and enable recycling of water and harnessing of nutrients. Reducing UFW through leakage identification, SCADA system for water supply, and providing good quality water by monitoring the water quality. The demand for water supply in city is escalating with increase in population and urbanization; however, there are strong opportunities for integration of smart water systems and recycling-reuse of water supply system.

### 4.2.2 Solid Waste Management

The present solid waste generation of city is 93 MT per day. Nearly 80% is the average waste collection efficiency. Segregation of solid waste at source is minimal. Considering Shimla city as a prominent tourist destination it is essential to strive for smart techniques for managing solid waste, this includes 100% segregation of dry and wet waste, provision

of compartmentalization of waste for proper waste segregation, optimizing the routing operations, recycling and reuse of waste and co-processing, composting and non-recyclable waste, Bin-leveling system for community bins, provision of underground waste bins at core city, provision of GPS system for the garbage transport vehicle fleet, automated system for real time monitoring for collection operations and at landfill and processing sites. The concept of decentralized waste management at ward level to manage the waste at source has also been identified as a smart mechanism for handling solid waste.

#### 4.2.3 Sewerage and Sanitation

The major issue of Shimla city drainage system is clogging of solid waste and discharge of grey water in water bodies. The overflow from septic tanks and soak pits enter into natural drains, and causes unpleasant odour. Leakages in sewer system due to breakage of sewer line causes mixing of sewerage with water supply. There is no connectivity between old and new sewerage systems at several places. Due to haphazard development activities, proper planning for waste management is not in place. The City Sanitation Plan for has also been prepared to address the issues of sanitation services but its implementation is only partial and there is need to employ appropriate technologies to improve the quality of water from storm water flows. It will help in conserving potable water and at the same time prevent water pollution. Following measures can be taken for adequate management of sewerage and sanitation system in city; comprehensive drainage mapping, storm water should nurture water bodies, cleaning and beautification of existing drains, Water harvesting, maintaining water table to ensure sustainability, reuse of water for landscaping and other purposes, smart manholes to tract sewer flow levels and decentralized sewerage treatment plants.

#### 4.2.4 Smart street Lights

Provision of intelligent street lights is essential for efficient energy management, and a perfect solution for energy saving especially in public lighting management for Shimla city. Building an energy saving smart lighting system with integrated sensors and controllers is necessary to adapt according to light, climatic conditions, time of day, traffic, and people movement. Similarly street lights can also be used for aesthetic purposes in core area and heritage zone of city to complement the heritage structures in city. Investments can also be made in alternative energy sources for public lighting like solar panels and solar cells.

#### 4.2.5 Institutional Infrastructure

The mandate of any smart governance is to provide set of services to its citizens, which is efficient, convenient, equitable, and affordable in effective manner. The city has taken innovative steps to implement the e-governance application for efficient delivery of various municipal services life water cess, property tax, building permissions and so forth. The use of ICT in municipal services will enhance transparency, accountability and equal accessibility to all. Smart administration will boost effective & optimum utilization of city resources and discharge of efficient & adequate services to its citizens in time.

#### 4.2.6 Smart Tourist Hub

The city of Shimla is a major tourist hub and experiences large influx of domestic and international tourist. The city presently has 92 listed heritage structures, 6 heritage zones, 1 ASI monument of National importance and 6 museums. Kalka Shimla railway line is a UNESCO world heritage site. Number of tourists witnessed by city during 2017 was 18.6 million. The hotels during peak summer season experience 100 per cent occupancy rate. Due to increasing tourists flow, city has witnessed crisis with respect to water supply, parking, degradation of environment, traffic congestion and other infrastructure services.

To sustain "tourism", there is a need to upgrade the city and regional infrastructure. There are huge development opportunities for future of tourism by developing forest trails and adventure sports in city region. Tourist activities should come up with environment and ecological imperatives. This will include combination of Internet of Things (IoT) technology with development of smart tourism industry and smart tourism centres at regional level. Smart tourism should build an IoT Information Technology public platform, covering service management to marketing management not only for Shimla city but for entire state. The technology of smart tourism includes Advanced Traveller Information Systems (ATIS), Advanced Vehicle Control Systems (AVCS), Advanced Commercial Vehicle Operation (ACVO), and Electronic Toll Collection System (ETC).

### 5. Healthcare and Education

Shimla as mentioned earlier acts as a Regional Centre for state level health facilities (Allopathic, Ayurveda and Veterinary hospital) and educational facilities (Schools, Colleges and Universities). More than 80% of city population is well served with good health facilities<sup>4</sup>, however, remaining 20% are not served well due to hilly terrain and poor accessibility.

The focus area for city and Shimla district will be in terms of developing quality private health facilities, availability of alternative diagnoses and remote treatment or tele-assistance in areas with poor road network and connectivity. With the use of new technologies, citizens can enjoy a number of on-line medical services, including key services such as requesting an appointment on-line or the possibility of having a digital record.

Similarly with an ICT network and digital technology suitable for the landscape can ensure an enhanced improvement in education and training with benefits such as reduced costs, flexible hours and greater interaction. The key element for incorporating smart education in city will be integrating digital development plans in classrooms that mainly focus on closing the digital divide, promoting the digital skills of teachers and students along with the new generation digital learning resources.

<sup>4</sup>Source: Ministry of Health and Family Welfare, 2015

## 5.1 Smart Citizens

Smart Governance is a means of using ICT to augment the public participation in the various democratic, legal, political facets of local Governments. The vision for a futuristic, sustainable, resilient and inclusive Smart city can not be completed without the involvement of smart citizens. Though this aspect of the Smart city concept is not limited to hill cities, but it suggests that technology can help in improving connectivity and accessibility with citizens even in difficult physical landscape.

### 5.1.1 ICT services

Application of smart applications such as smart surveillance, smart grid, smart metering, smart lighting, Remote Expert for Government Services (REGS), Wi Fi Grid etc. leading to the creation of databases and dashboards for City Infrastructure Management have a direct impact on citizen's quality of life. This includes, providing technological solutions using sensors and the internet to solve a range of city problems, from water leaks and air pollution to traffic congestion and the garbage crisis. Provision of reliable utility services is essential for smart city.

In times to come through use of ICT, citizen participation would mean the direct involvement of citizens in the process of administrative decision making, policy formulation and implementation. The decisions will be taken at local level and with well-established processes through which the citizens can actively participate in such decision making towards city governance. Formation of Ward Committees and Ward Sabha in city is one of the first initiatives towards participatory planning and decentralized planning approach.

## 6. Networking Homes with workplaces

The smart city shall focus on developing creative enterprises with the use of ICT for creating job opportunities in city and its region. Economic development is envisaged based on new reliable data sets to create new business and services viz-a-viz boosting local business at competitive prices. The majority of our employment opportunities are still bundling around the urban core of the city. The lopsided development has resulted in issues related to traffic problems, congestion at Cart road and other key commuting corridors including long work journeys and low productivity etc. A smart solution is needed to combat these issues. Employment should be considered as an integral part of strategic planning framework in addition to integrated land-use-transport-environment planning framework. The focus will be to achieve a balanced development pattern whereby employment opportunities would be decentralized to extended special areas and new proposed towns of the city, it is pertinent to strategically identify and locate the employment clusters. Networking homes and workplaces with efficient, convenient, and pleasant transport and walking facilities as well as commuting services. Opportunities should further be explored to shared working space, business centres near cluster of villages, and workplaces for boosting innovation and creativity.

## 7. Way Forward

The planning context in Indian scenario has a golden opportunity under the various infrastructural development schemes launched by Ministry of Housing and Urban Affairs for development of cities and its infrastructure using cutting edge technologies. The future of cities depends upon how contextually the city issues are dealt, with better use of technology, and the capability and commitment of urban managers and users.

Hill cities are multifaceted and ever transforming and a more inclusive and holistic approach to planning and applying the Smart City technologies may award better results. Critical issues like environment, land availability, efficiency in delivery of urban services such as water, urban transport including land use planning requires more comprehensive planning with application of ICT. Use of smart technologies will foster efficiency in services, promote smart and organised city growth and will also make hill cities more accessible with the use of real time data.

## References

- [1] Benjamin L. S., (2018) "Towards a sustainable smart city: The case of Aizawl" ORF Special Report, accessed at <https://www.orfonline.org>
- [2] Kumar .A., Garg P., (January 2014) *Vernacular practices: as a basis for formulating building regulations for hilly areas*, published in International Journal of Sustainable Built Environment, accessed at <https://www.researchgate.net/publication,DOI:10.1016/j.ijse.2014.01.001>
- [3] Kumar A., Garg P., (April 2014) *Building regulations for environmental protection in Indian hill towns*, International Journal of Sustainable Built Environment, accessed at <https://www.researchgate.net/publication,DOI:10.1016/j.ijse.2014.01.003>
- [4] Kumar A.(2015) *Impact of building regulations on Indian hill towns*, Housing and Building National Research Center accessed at <https://doi.org/10.1016/j.hbrj.2015.02.002>
- [5] ICLEI, (June 2013) *Climate Resilience Strategy Shimla*, Published by Shimla Municipal Corporation.
- [6] Municipal Corporation of Shimla.,(2011) *Shimla City Mobility Plan* Prepared by Urban Mass Transit Company Limited, accessed at <https://docz.net/doc/3814791/comprehensive-mobility-plan-shimla>
- [7] Ministry of Urban Development. (2015)., *Smart city mission transformation, Mission Statement And Guidelines*,
- [8] Ministry of Urban Development, (October 2013), *Draft Report on Capacity Building for Urban Development: Rapid Baseline Assessment of Shimla City*, Prepared by CRISIL Infrastructure
- [9] Ministry of Urban Development, (2015), *Draft City Development Plan Shimla*, Prepared by CRISIL Infrastructure
- [10] Municipal Corporation of Shimla, (June 2017) *Smart City Plan Proposal*

- [11] Shekhar, S. 2011. Urban Sprawl and other Spatial Planning Issues in Shimla, Himachal Pradesh, Institute of Town Planners, India Journal, vol. 8, no. 3
- [12] Shukla P., (2015), *Smart Cities in India*, Published by TERI, New Delhi
- [13] The Hong Kong Institute of Surveyors, Annual Conference Proceedings Report (2014 ), *Our Smart City in Next 30 years*, Published by The Hong Kong Institute of Surveyors., <https://www.hkis.org.hk/>
- [14] Town and Country Planning Department Government of Himachal Pradesh,.(2012), *Draft Development Plan of Shimla Planning Area*, <http://tcp.hp.gov.in/>