Prospects and Constraints in Development of Varanasi as Smart City, India

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Abstract

At Present 33.66 million (27.8% of total population of 1.2 billion persons, Census of India, 2011) people of India live in 4041 statutory towns, 3894 census towns, 475 Urban agglomerations and 981 outgrowths. Out of this urban population, 43% (14.47 million) reside in only 53 million cities and 70% reside in Class I cities. Three urban agglomerations viz. Greater Mumbai, Delhi and Kolkata have crossed the 10 million mark in population and five cities viz. Chennai, Bengaluru, Hyderabad, Ahmedabad and Pune have attained more than 5 million population [13]. Such a large number of urban places and people pose serious challenge to the planners and government on their qualitative of life and sustainable development. This paper is an attempt to examine the concept of smart city in respect of Varanasi in the state of Uttar Pradesh (79.79 sq km area and 1.4 million population). Varanasi is a very ancient city which is famous for the temple of *Baba Vishwanath (Hindus)*, Sarnath (*Buddhists*), music, learning, silk weaving, handicrafts, textiles, toys, ornaments, metal ware, wood works, crafts, etc. Government of India has proposed to develop the city as a smart city with confluence of heritage and modernity by 2019. The present study is based on discussing the prospects and constraints in the proposal and give some viable recommendations for development of the city. This paper argues that sustainable smart cities policy should be adopted utilizing modern information and communication technology while avoiding the haphazard development. It discusses the scope of sustainable development through different parameters and policy to achieve smart city status of Varanasi.

Keywords: *smart city, tourism, sustainable development, heritage and e-governance*

Introduction

Before adopting smart city development plan, it is important to address socio-economic, political and environmental concerns. There is no existing evidence in India that can explain if tenets of sustainable cities are affected by, for example, residential density, transport accessibility and layout [7]. Prime Minister of India Mr. Narendra Modi announced his vision to set up 100 smart cities across the country by 2019 [3] Varanasi in Eastern Uttar Pradesh State has also been selected to be developed as a 'smart city' with cooperation from Kyoto, the Japanese 'smart city' which is a confluence of heritage and modernity. According to the ministry's proposed plan, the city's heritage structures are to be restored even as its infrastructure is to be upgraded. Three sub cities; Sarnath, Banaras Hindu University and Airport City would be carved out as smart sub-cities, interconnected by a network of flyovers. The idea is to ensure that commuting from one sub-city to another does not take more than 30 minutes. The proposed transport infrastructure also includes a metro rail, an

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Information Technology (IT) park, a skill development centre and an Information Technology research and development centre. The ministry plans to restore the Sarnath Temple, the Jain temples of Varanasi with help from the Archaeological Survey of India. There is plan to open an International Centre for Hinduism, Jainism and Buddhism studies. An academy for music and dance and a school of Oriental learning have also been proposed in the smart plan. To promote art and culture, three museums (one each dedicated to textiles, culture and tourism) and a Bhojpuri film festival are on the cards. The river beautification involves the redevelopment of a 100 ghats in Varanasi. An inland waterway between Allahabad to Kolkata is also proposed. The plan is likely to be launched on December 25, former Prime Minister Atal Bihari Vajpayee's birthday. The entire makeover is expected to be complete in three phases, ending by 2019 [2]

Smart city

The concept of a Smart City is not new. It supplements the earlier neighborhood concepts and sustainable cities programmes of last two-three decades. The concept of the smart city focuses mainly on the role of infrastructure, but much research has also been carried out on the role of human capital, social and relational capital and environmental interest as important drivers of urban growth [8]. Smart city is to be equipped with advanced basic infrastructure facilities and amenities such as; electricity, water, transport, e-governance, etc., to ensure a good quality of life ensuring a sustainable living environment. The smart solutions to civic problems include; e-governance providing online public information, grievance redressal, e service delivery, civic waste to compost, energy & fuel, waste water and sewage treatment, renewable energy resources, smart parking,

etc. In India, the guidelines for recognizing a city as the smart city is prepared by the department of industrial policy and promotion. The basic criteria includes; Implementation of e-governance and online grievance redressal mechanism, putting all government expenditure online for public, Publication of e-news letter, Swachh Bharat (All India Sanitation Programme) in which at least 5% increase in coverage of latrines should be observed since 2011, track record of paying salary to employees and track record of urban reforms and citizens participation. Under Smart City Program of India, Each Smart city will get Central fund of Rs 100 crore for 5 years under which a Special Purpose Vehicle (SPV) will be created with the civic local body, state government and the Centre for implementation of the project. Some typical features of comprehensive development in Smart Cities are described below [10].

i. Promoting mixed land use in area-based developments — planning for 'unplanned areas' containing a range of compatible activities and land uses close to one another in order to make land use more efficient. The States will enable some flexibility in land use and building bye-laws to adapt to change;

ii. Housing and inclusiveness — expand housing opportunities for all;

iii. Creating walkable localities — reduce congestion, air pollution and resource depletion, boost local economy, promote interactions and ensure security. The road network is created or refurbished not only for vehicles and public transport, but also for pedestrians and cyclists, and necessary administrative services are offered within walking or cycling distance;

iv. Preserving and developing open spaces — parks, playgrounds, and recreational spaces in order to enhance the quality of life of citizens, reduce the urban

heat effects in Areas and generally promote eco-balance;

v. Promoting a variety of transport options — Transit Oriented Development (TOD), public transport and last mile para-transport connectivity;

vi. Making governance citizen-friendly and cost effective — increasingly rely on online services to bring about accountability and transparency, especially using mobiles to reduce cost of services and providing services without having to go to municipal offices; form e-groups to listen to people and obtain feedback and use online monitoring of programs and activities with the aid of cyber tour of worksites;

vii. Giving an identity to the city — based on its main economic activity, such as local cuisine, health, education, arts and craft, culture, sports goods, furniture, hosiery, textile, dairy, etc;

viii. Applying Smart Solutions to infrastructure and services in area-based development in order to make them better. For example, making Areas less vulnerable to disasters, using fewer resources, and providing cheaper services.

Varanasi City Profile

Varanasi is one of the oldest living cities in the world. Its histogenesis and culture span more than 4000 years. The city extends between the 25°15' to 25°22' N and 82°57' to 83°01' E. The River Ganges flows South to North along the city. It has over hundred famous river front terraces called as *Ghats* in hindi, (Fig.1). The tract of land lying between the two rivers of *Varuna* in north and the *Assi* in south of the city is called Varuna+Assi = Varanasi. It is situated in the fertile alluvial Gangetic plains. The climate of the town is sub tropical with temperature varying from 5°C in winter to 45°C in summer. The annual rainfall varies from 65cm to 150cm with larger rainfall during July to September. The city attracts a large number of
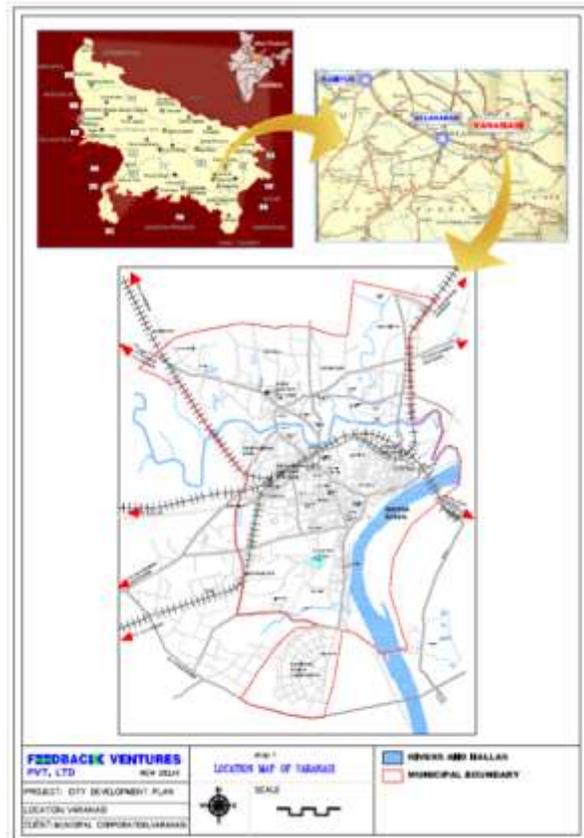
Figure 1

pilgrims, worshippers, traders, artisans and tourists from all over the world. The experience of boating or sitting at *ghats* while watching the morning sunrays falling over the river and the ghats at the background of *vedic* hymn chanting and temple bells is spell bound. The traditional breakfast of the city is *puri-kachouri-jalebi*. Another traditional mouth freshening chewing item is *paan (betel leaf),* which can't be described in words unless taken. A refreshing dip in the river Ganges waters followed by walking along the ghats are very scintillating. The city has rich tradition of vocal and instrumental music, handicrafts, metal and wood arts, crafts and education. The art of silk weaving and preparation of traditional Indian dress called as Banarasi Silk *Sarees* and Silk brocades are always

precious collector's items. Varanasi is well connected by road, rail and air with other parts of the country . The existing Varanasi city profile can be classified into three main categories as following (Fig.2):
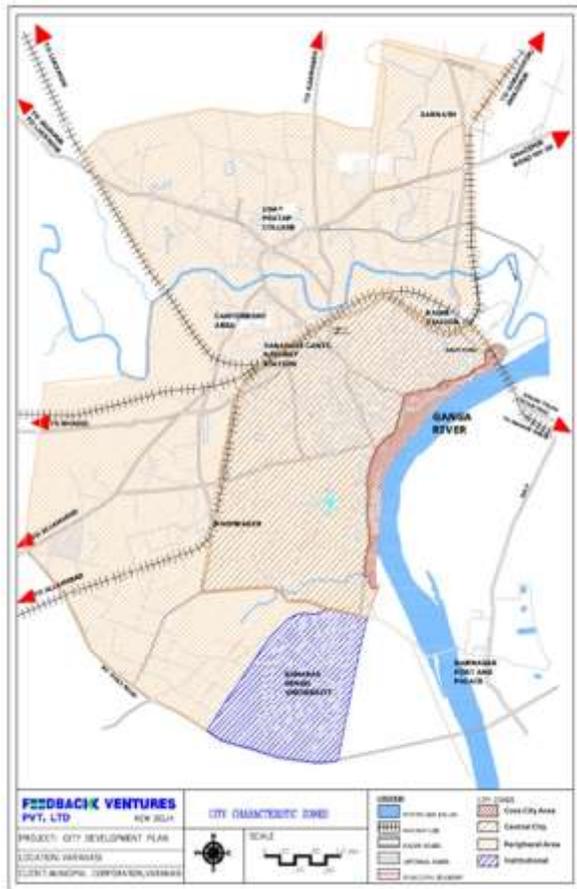

Figure 2 : City Profile

1. The Old City: The traditional old city of Varanasi covers the areas around hundred of river ghats having old temples, water bodies along with retail and wholesale commercial areas. It has highly congested houses, markets and narrow streets. The areas of *Chowk, Kotwali, Gai Ghat, Kashi, Adampura,* etc., fall under this category

2. The Central City: The central city borders the old city. It has all services, facilities   and cultural attractions with relatively lesser population density, traffic congestion and pollution. The areas of central city include Railway station, Cantonment area, Diesel Locomotives Works Factory and Institutional areas like *Kashi Vidyapeeth*, Banaras Hindu University and *Acharya Sampurnanand Sanskrit* University.

3. Peripheral Areas: The peripheral areas are encompassed by the new municipal wards. They and becoming more popular among the citizens as they provide more organized development pattern with infrastructure in relatively better conditions. The State Housing Board, through the Varanasi Development Authority, undertakes these developments. The demand for such development is increasing with the participation of governmental and private development groups. The growth of peripheral areas is likely to be much higher in comparison to other parts of the city. The proposal for the construction of ring road in this zone has further accelerated the development process.

Importance of Tourism and Heritage

Tourism is the main source of income to the city**.** People from all over the world love to visit Varanasi owing to the long cultural heritage of river front terraces (*Ghats*), temples, sacred ponds, pilgrimage circuits, fairs, festivals and important heritage sites.   River front terraces *(Ghats)* and Ponds*(Kunds)* beautify the crescent shaped bank of river Ganges. These hundred river front terraces or *ghats* on the western bank spread over a distance of 7 km. The hindu pilgrims chant *Vedic* hymns as prayers, take holy dip in the river Ganges, perform cremation and religious offerings and circumnavigate along pilgrim circuits. The most important *ghats* are *Dasaswamedh, Harish Chandra, Manikarnika, Panchaganga, and Assi ghat.* There are many sacred ponds or *kunds* within the old temple complexes or along the *ghats* in the old city. Many of these kunds have been lost to the encroachment by people who

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built residential and commercial units. Some of the important kunds are *Lolar Kund, Durga Kund and Pittar Kund.* Besides the Ghats, there are approximately 2000 temples throughout the city. Many important temples are located along the *ghats* of the Ganges. Some of the important temples are *Kashi Vishwanath, the Sankat Mochan temple, The Tulsi Manas temple, the Durga temple, the Kal Bhairav temple and the Mritunjaya temple.*Varanasi has five sacred territories *or Khandas* and each *Khanda* has a sacred *yatra* (circumnavigation of the city and important religious and heritage sites) associated with it. These yatras are: *Chaurassikosi yatra, Panchkroshi yatra, Nagar Pradakshina, Avimukta yatra* and *Antargraha Yatra*. Most of these *yatras* are concentrated in the old city area along the riverfront. These five pilgrimage circuits are like a garland consisting of different number of shrines in a chain, further denoting the numerical archetype symbolising universal patterns of integration among the levels of cosmic manifestation clearly three levels are marked. The symbolisation of any number can be narrated around the cosmogonic homology, commonly interlinking macrocosmos (the celestial world), mesocosmos (the terrestrial world), and microcosmos (the phenomenal world/ realm of consciousness) [9].

The city hosts a large number of fairs and festivals throughout the year. The importance of these festivals can be seen from the number of pilgrims arriving and attending the fairs. Famous fairs and festivals of the city include *Nag Nathaia* in presence of the royal highness of Ramnagar, *Rathyatra* of lord *Jagannath, Navratri, Dev Deeepawali, Mahashivratri,* etc. Ramnagar Fort (17th century) is well preserved with the royal highness King of Varanasi sill residing in it. It has a museum displaying the Royal collection

of palanquins, elephant howdahs made of silver brocades, royal seat, armoury of swords and guns, vintage cars, ivory works and antique clocks. The *Dussehra* festival of the fort is world famous. *Sarnath* is located 10km north from the city. It is world famous site for Buddhists. At *Sarnath*, *Gautam Buddha* gave his first sermon after getting enlightenment to his five pupils 2700 years ago. Later the great emperor of India, Ashoka became follower of Buddhism (250 B.C.) and laid foundation of many buddhist monasteries, edicts and inscriptions of Buddhism. Lion Capital of Sarnath is national emblem of India and the *Ashoka Chakra* (Wheel with 24 spokes signifying 24 hours in a day) of the capital is adopted in the flag and currency of India. Sarnath Museum has many buddhist sculptures, inscriptions, edicts and idols. The excavated site of Ashoka inscriptions along with adjacent deer park is an attractive tourist and leisure spot as well.

Significant Prospects and Constraints

Varanasi town has shown a constant increase in the population over the years. In the last eight decades the population has grown seven folds (from 207,650 persons in 1931 to 1,435,113 persons in 2011). The estimated daily inflow of tourists and pilgrims to the city is 25,000 [6]. People from neighbouring towns and villages of Uttar Pradesh and Bihar migrate in large numbers to Varanasi increasing whooping population. This migration has increased the demand of low and middle income group residences. Planning is required for this section of population to avoid any squatter settlements and slums.The economy of the city is based on tourism, silk and cotton textiles, handicrafts, metal and wood arts & artifacts. Varanasi's informal economy is very poor with only Diesel Locomotive Works (DLW) as a big industry located in *Maduadih*. The other industries are Small

Scale and cottage with no guarantee of any future growth. Workers and working conditions in commercial, cottage and Small scale industrial units are pathetic and lack high level skills. The tourism sector is the only booming sector of economy whose peak season is between October to March. There is a pronounced lack of physical infrastructure and accommodation facilities in the city. The supportive infrastructure facilities as electricity and water supply are very poor. The city is converting into concrete structures with very less open spaces and green belts deteriorating its sustainable living environment. The modification of urban spaces in the old city could also negatively alter the religious and cultural life. Increasing population is leading to more number of vehicles and traffic congestion, not only at peak hours but at most hours of the day leads to noise pollution and smog. The rapid increase in the number of tourist every year has created a stress on the city heritage areas and infrastructure.

Highly congested traffic of Varanasi is a big challenge. The Mixed traffic volume with large number of slow moving traffic mainly rickshaws, cycles, motorcycles, cars, trucks, buses etc. on the roads encroached by street hawkers, temporary shops, extensions of existing shops, roadside parking , etc., has posed serious challenges. Absence of auto rickshaw stands and parking spaces at major intersections and market has left the city in chaos. Non-signalized intersections have lead to mismanagement of traffic in the city. On the contrary, two bus stands in center of the city should be relocated immediately. The traffic congestion adds to heavy noise and air pollution too. Absence of footpath for pedestrian movement invites many accidents. There are many poles and transformers in the middle of road,

which needs shifting for smooth traffic flow. Lack of plantation and open spaces, especially in the old city cause very high pollution.

Urban Development of Varanasi can be seen along the arc of the Ganges. The city development has expanded westwards in peripheral areas. Varanasi master plan 2011 reveals that the residential land use is 52% of the total. The housing density is approximately 2167 house hold per Sq. Km. There was shortage of 90,000 houses in year 2001, 119,954 in 2011 and further to 139,657 in 2025. The Industrial area constitute only 3.66% and commercial 3.45%, which is serious issue to address in urban development plan. There is reduction in the agricultural land use, which depicts that rural agricultural land on the fringe and suburbs are gradually being used up for building new colonies

Sl no	Land Use	Proposed for 2011	
		Area in Ha	Percentage
1	Residential	9254.61	51.61
2	Commercial	618.23	3.45
3	Industrial	656.19	3.66
4	Public and Semi Public	1309.07	7.30
5	Recreational	984.47	5.49
6	Services	103.97	0.58
7	Govt. and Semi-Govt.	1433.15	7.99
8	Tourism and Heritage	423.73	2.37
9	Transport and Communication	1460.35	8.15
10	Agriculture	1683.45	9.39
	Total	17927.22	100.00

Source: Master Plan-2011, Varanasi

Another major problems of the city is poor drinking water quality. The river water is contaminated by thrown flowers, garbage, untreated disposed water from residential, commercial and industrial units, throwing burn/un-burnt human and animal dead bodies, etc. The pipelines are very old, deep down under the ground, leaking and overlap with sewer lines. Leakages in the water supply are very common. Many times they get contaminated by sewer lines, open drains and channels. More storage capacity and Over Head Tanks are required to meet the growing demand of drinking water. The existing sewerage system is inadequate with 70% area of the city uncovered with

sewer system leading to discharge of untreated sewage in open drains polluting river. Capacity of Sewerage Treatment Plants is inadequate to treat the existing sewage leading to disposal of untreated sewer into the river. It becomes a major challenge especially during the rainy season due to clogging of sewerage system contributed by sewer, storm water, drainage and waste dumps. In spite of the three STPs constructed in Varanasi under the GAP (STP at Dinapur – 80 MLD, STP at Bhagwanpur – 8 MLD and STP at DLW – 12 MLD), only around 90MLD (Million Litre per Day) of the total wastewater generated is treated. The rest finds its way into the Ganges either through river *Varuna* (after it is given primary treatment at Konia) or directly through open drains discharging into the river. Since, the existing sewer network serves as a storm water cum sewerage network, the capacity of the STPs is reduced, especially during monsoons and this in turn leads to extensive pollution of River Ganges [4]

The smart city concept should have the goal of creating socially inclusive cities that empower citizens to satisfy basic needs and to participate in urban life. This goal is presented as a combination of "Green" and "Brown" agendas referring to long term environmental goals and short-term environmental issues such as air or water pollution and waste management [1]. Varanasi civic body is not efficient in proper system of collection, transportation and disposal of the urban waste. Many of these activities are still manual causing health hazard to the workers. People are not aware of biodegradable and non biodegradable wastes. There is not enough staff for sweeping the roads of Varanasi, making it difficult to clean the city. Condition of the vehicles carrying waste is very poor and needs proper maintenance/replacement. They are not covered resulting in spread of foul smell as the vehicle moves around the town for collection and disposal of the waste. Waste dumps in city canals and rivers leading to water logging and unsanitary conditions. Civic authorities have failed to control the strew animals in the city who pollute the land and water with openly defecating excreta and bath in the rivers and water bodies of the city.

The civic administration of the city is working without proper coordination among different bodies. Several activities of different civic bodies are similar and overlapping but carried out separately. For example; Municipal Corporation collects Property Tax and Water Board collects Water Tax, Water Charge and Sewer Tax from the residents. Tax Collectors of both the departments visit the same household separately and the tax payer has to visit two different offices for payments or complaint redressal; Varanasi Development Authority (VDA) collects development charges for plot development whereas all infrastructure/ services are provided and maintained by Municipal Corporation and Water Board; VDA uses Water Board water supply for housing development. An amount fixed up as certain percentage of cost of construction is paid by VDA to Water Board for this service. However, this payment often gets delayed adding to the financial problems of Water Board. They do not have any website and it is tough to ensure e-governance without making digitizing records and making them online. They still depend a lot on paper work. They are not able to recover the cost of services rendered by them. There is big resource gap for performing the basic core functions like public health, sanitation, and waste management. They do not have proper asset and audit records. The revenue and expenditure are generally estimated on *ad hoc* basis from the previous year expenditure. This previous year

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expenditure is also not analyzed in great detail i.e. trend analysis, to understand the factors influencing the revenue and expenditure

Suggestions and Recommendations

Varanasi being the important city of religion and tourism needs proper urban renewal program in which people's participation is vital. The city lacks formal open spaces under recreational or green spaces. The proposed Master Plan provision for green areas is only 5.49% of the total area [5]. There is a need for provision of more green areas in the city, especially in the Trans *Varuna* Region. Extensive roadside plantation programs also need to be undertaken to maintain the ecological balance of the city. The city has 227 slums, which are mainly concentrated on the *Varuna* side and need provision of proper infrastructural facilities and their socio-economic upliftment. Varanasi does not have a major industrial base. DLW is the largest industry in the city. Proper industrial planning is required to initiate development of heavy industries. The handloom industry deploys coal fired boilers and dump waste water in open drains after dying. Both of these practices should be stopped. Traffic congestion can be resolved by widening of roads and bridges to remove transport bottlenecks and construction of terminal facilities as bus, truck and auto stands. Laying of ring roads and by-passes around cities, provided certain cost recovery measures like toll charges are built in Construction of working women hostels, marriage halls, old age and destitute children's homes, night shelters with community toilets are required. New housing development schemes should be linked with proper transport facilities. The temples, river terraces, ponds, heritage sites and places need proper maintenance. There is need to have public participation at different levels of development plan,

right from formulation to its implementation and also its review [12] The provision of two committees viz; Tourism Development & Heritage Conservation Committee and Sanitation Committee with participation of the government employees, local people, lawyers and media persons would serve the cause of city development.

The former should work to promote the promotion of tourism with improved facilities of tour and travels, accommodation, hospitality, sanitation and security. New tourism attractions should be provided and publicized as; Yoga, meditations, Spiritual learning and training, promoting naturopathy in terms of *Ayurveda, Unani*, Homeopathy, herbal spa, adventure sports, eco-tourism in nearby natural places, water cruises in river, film locales, tourist sports etc. Majority of the heritage monuments and sites are located in the old city. Redevelopment of the old city requires widening of narrow streets, shifting of industrial/commercial establishments to outskirts of the city. The committees should make people aware of the pollution caused due to throwing of flowers and other items in the rives and along the river terraces/ghats. The penalties on polluting rivers, water bodies, streets, pavement and damaging any heritage monument or site should be collected by the former committee to self sustain. The matter can be reported to the local police if the offender repeats his/her act for legal action.

Similarly the sanitation committees should take serious note of anyone throwing the wastes and trashes on public places. The committee should take note of any need of replacement of drainage or sewerage pipelines. Any leakage of network should be immediately fixed. The members should make people aware of the sanitation and employ staff who can

separate bio degradable and non biodegradable wastes, transport and dump them scientifically. Separate dustbin should be kept all over the city and public awareness should be created to segregate these wastes into bio degradable (Green Dust Bin) and non biodegradable (Brown Dust Bin). The challenges of operation and maintenance of drainage, sewerage and solid waste management requires trained man power in adequate number along with new vehicles, dust bins, trashes, etc. , They should know how to handle them scientifically; as how to fix the alignment of pipelines, sewer lines, solid wastes, segregate biodegradable and non biodegradable wastes, etc. A formal sanitary landfill site is required for the city. Presently it is dumped near *Rajghat* and in the absence of any preventive measures, the leachette generated finds its way into the ground water and the channels leading to river Ganges [11]. A proper Sewerage Management plan is required for construction of more Sewerage Treatment Plants to intercept untreated sewage entering the river. The city has an intensive network of open drains which act as outlets for waste water discharge and solid waste dumping. Since most of these drains are unlined, they lead to ground water contamination. Siltation and blocking of drains due to solid waste disposal is leading to unhygienic conditions. Regular removal of siltation and unblocking of the drainage network is required. The scarcity of sanitary workers can be sorted out with involvement of more casual staff on daily basis. The water supply to the city is heavily dependant on ground water, especially for the trans Varuna area and institutional areas leading to depletion of water table. Contamination of water table due to discharges from open drains, cannels and waste dumps is a major cause of concern which must be addressed.

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