Chapter 7
Redefining and Exploring the Smart City Concept in Indian Perspective: Case Study of Varanasi

Sunny Bansal, Vidhu Pandey, and Joy Sen

Abstract Urbanisation as a phenomenon has existed since long. By 2050 almost 70 % of world's population will live in cities, hence a demand for more efficient urban systems. With many trends coming up on the urbanisation front, from 'liveable cities' to 'inclusive urban growth', the latest concern is of 'smart cities'. As an umbrella concept, smart cities have three subparts: human intelligence, collective intelligence and artificial intelligence (ICT), of which the latter is taking up the major limelight. While assessing India's urban conditions, it can be gauged out that there are various prerequisites before embedding ICT into the system. This paper attempts to redefine the smart city concept in Indian perspective reviewed through the lens of human + collective intelligence. Varanasi which has been proposed as one of the smart cities to be developed would be taken as a case study.

Varanasi, being synonymous to living continuity of traditions and deep culture, possesses a legacy of institutions for learning and innovation. However, rapid and haphazard urbanisation has disturbed the delicate balance between the city's various facets thereby making it a living laboratory for carrying out the 'smart' urban experiments. The paper takes up a holistic approach for evolving the smart city criteria and intends to define it on the basis of prioritisation models. The approach used in this paper for the purpose of analytics is 'interpretive structural modelling (ISM)'.

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7.1 Introduction

India has been home to one of the ancient civilisations in the world. Cities have taken birth, evolved and flourished on this land. It has accepted, amalgamated and assimilated various cultures and traditions into it which has kept explorers, merchants and people in general attracted to this ancient country.

Throughout this century the cities have been conceived by sociologists, planners and engineers as 'a bazaar, a seat of political chaos, an infernal machine, a circuit, and more hopefully, as a community, the human creation par excellence' (Newman 1999). By 2050 almost 70 % of the world's population will live in cities, hence a demand for more efficient urban systems. India being one of the major stakeholders, as is predicted by 2050 (International Business Times 2013) that India will become the most populous country swapping its position with China, needs to get in tune with latest tools and techniques which would serve to counter the negative effect of urbanisation and growing population and thus, preventing the ultimate collapse of our cities.

There have been many models to counter this plaguing phenomenon of urbanisation and channelise it into a more inclusive growth mode. This has included terms like liveable cities, zero-carbon cities, eco cities, green cities and smart cities. Smart cities being the latest on the scene offer a threefold application areas which need to be explored holistically. They are human (individual), collective (group/community/institution) and artificial intelligence (ICT).

The paper tries to explore 'why' and 'how' community participation and communication are necessary for smart community planning which in turn is important to achieve a holistic smart city for fast-developing countries like India. Varanasi has been taken as the case study for the application of the model.

7.2 Smart City Concept

The idea of smart cities has taken the twenty-first century by an enormous amount of enthusiasm exhibited in equal measures by both the developing and the fast-developing nations. Smart city concept is relatively new and highly context dependent (country, government, natural resources, IT knowledge and capacities) (Weisi and Ping 2014) which has in turn generated its diverse concepts. Some of the concepts have been taken under review (Table 7.1).

7.2.1 *Review of Definitions*

Table 7.1 Definition for smart cities

Definitions	Inferences
'A city well performing in a forward-looking way in economy, people, governance, mobility, environment, and living, built on the smart combination of endowments and activities of self-decisive, independent and aware citizens' (Giffinger et al. 2007)	Holistic approach
	Aware citizens
	Human intelligence centric
'The use of Smart Computing technologies to make the critical infrastructure components and services of a city-which include city administration, education, healthcare, public safety, real estate, transportation, and utilities- more intelligent, interconnected, and efficient' (Washburn et al. 2010)	Emphasis on smart computing technologies
'It is the implementation and deployment of information and communication technology infrastructures to support social and urban growth through improving the economy, citizens' involvement and governmental efficiency' (Hollands 2008)	Emphasis on ICT

7.2.2 *Umbrella Concept for Smart Cities*

Smart city as an umbrella concept has three broad dimensions to it: human intelligence, collective intelligence and information communication technology (ICT) (Taewoo and Theresa 2011). In ideal situation, all the three components have equal participation for the configuration of smart cities. This has been further modified into five principal axes (B. Mattoni et al. 2015), and the area of concern for this paper is 'smart community and communication' (Fig. 7.1).

7.3 Need for Smart Community Planning in Indian Perspective

India is an ancient land, and when talking about ancient lands, it is observed that the rate of acceptance of culture and rate of acceptance of technological advances vary. Seldom these places adapt easily to changing environments and accept the technological efficiencies, which might be due to various reasons including scarcity of resources, reluctance to adapt to a changing environment on the community's part, etc., among various others.

India being a developing nation has still not yet implemented the nuances of a planned and sustainable living in its developing scenario. Hence it is the need of the hour to define a proper framework of workable strategy which can be evolved and applied in the smart city revolution of India.

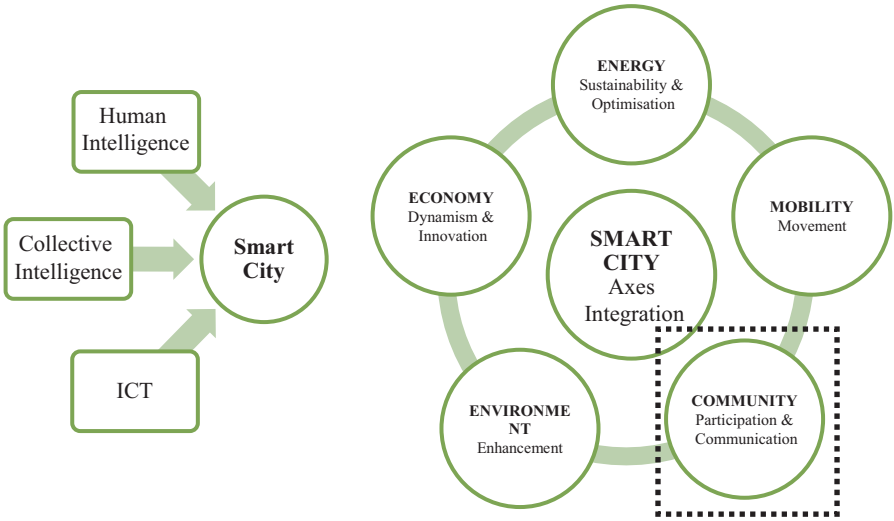

Fig. 7.1 Major components of smart city and its five axes

7.4 Challenges Faced by Cities Attempting to Become 'Smart'

A city behaves like an organism governed by various permutation and combination of services, and it is difficult to have an ideal situation (Newman 1999). The microscopic part of the modern city is people, and people themselves are open complex giant system (Cosgrave and Tryfonas 2012). The city puts so many people together, with energy, information, capital, labour, various economic, scientific knowledge and life infrastructure as the regional economy, politics, culture, education and science and technology information centre (Weisi and Ping 2014).

Sociopolitical elements cumulated along with lack of awareness among citizens have misinformed the direction of smart city revolution. The emphasis has solely been shifted on the 'ICT portion', whereas the other two criteria are getting neglected. Thus the major challenge faced by cities all over the world in general and India specifically is to steer it back towards its 'human component' or the 'human + collective intelligence' or 'smart community planning'. Here, smart community planning can be identified as planning for the betterment of communities in the long run. It will include assessing the current scenarios/conditions of the community (of a particular place/region) and then formulating planning frameworks integrated with smart solutions accordingly. This will also mean taking the people centric approach in the foreground, so that they not only remain on the receiving end of policy frameworks but can also act as catalysts of transformation.

7.5 Configuration of Traditional Heritage City Under 'Smart' Framework: Case of Varanasi

Mark Twain puts it himself: 'Benares is older than history, older than tradition, older even than legend and looks twice as old as all of them put together'. Varanasi is one of the oldest continuously living cities in the world whose fabric is woven across the web of interconnecting lanes, serving myriad services and in its ghats, along which thrives trade, commerce and lives.

Varanasi is already a creative city, that is, which inspires a sharing of culture and knowledge (Rios 2008). It has been a hub of artists, performers and craftsmen since long. The spiritual scene of the city renders it with a unique temple economy which in turn has led to evolution of various allied activities and services sprouting alongside 'ghats'. It could be said that in Varanasi, there exists an organic smartness with a potential to be structuralised. Moreover, the existing symbiotic relationship of base population and floating population due to its spiritual tourism makes this city more apt as a case study to examine the idea of smart urban experiment from the perspective of smart community planning.

7.6 Selection of Parameters for Smart Cities

To establish the groundwork for smart community planning, it involved the identification of requisite parameters. This has been done through literature studies, with major ones including 'smart communities project by Caltrans', a study by Mattoni, B.; Gugliermetti, F.; and Bisegna, F., 2015, among others. The parameters have been identified under two heads. Table 7.2 contains the smart community parameters for a generic smart city, while in Table 7.3, certain parameters specific (in italics) to Varanasi, like spiritual tourism economy, creative economic systems, etc., have been added because smart city concept can be more elaborately illustrated only when it is region specific.

7.6.1 Parameters of Varanasi

- *Symbiotic relationship between base population and floating population*: the city of Varanasi is characterised by its unique spiritual tourism phenomenon which makes it susceptible to increased load on its infrastructure due to floating population. This floating population can also be regarded as a source for revenue generation in terms of tourism. Since the study assesses the case for its smart potential with respect to community planning, hence it is required to examine the symbiotic relationship of floating population with base population.

Table 7.2 Parameters for generic city

S. No.	Parameter
I.	**Live**
1.	Interaction among the community members
2.	Personal autonomy and privacy
3.	Affinity and accessibility to information and communication
4.	Equal acknowledgement and services to all the members
II.	**Work**
5.	Job creation and entrepreneurship
6.	Inter-organisational networking
7.	Regional economy, community capital and self-help local organisations
8.	Local business participation in national or global markets
III.	**Learn**
9.	Public accessibility to technology and telecommunications for educational purposes
10.	Computer literacy and its usage
11.	Involvement of youth in community service
12.	Skill development
IV.	**Play**
13.	Usage of ICT by youth and sports organisations
14.	Community events organisation
15.	Online entertainment and web pages
V.	**Govern**
16.	Civic participation and participatory development
17.	Contact between citizen-government and intra-government communication
VI.	**Travel**
18.	Efficient traffic flow
19.	Use of alternative modes of transport

Table 7.3 Parameters for Varanasi

S. No.	Parameter
I.	**Live**
1.	Interaction among the community members
2.	Personal autonomy and privacy
3.	Affinity and accessibility to information and communication
4.	Equal acknowledgement and services to all the members
5.	*Symbiotic relationship between base population and floating population*
II.	**Work**
6.	Job creation and entrepreneurship
7.	Inter-organisational networking
8.	Regional economy, community capital and self-help local organisations
9.	Local business participation in national or global markets

(continued)

Table 7.3 (continued)

S. No.	Parameter
10.	*Spiritual tourism economy*
11.	*Creative economic systems*
12.	*Land river interface-based economy*
III.	**Learn**
13.	Public accessibility to technology and telecommunication for educational purposes
14.	Computer literacy and its usage
15.	Involvement of youth in community service
16.	Skill development
17.	*Performing arts development*
18.	*Spiritual knowledge dissemination and augmentation*
IV.	**Play**
19.	Usage of ICT by youth and sports organisations
20.	Community events organisation
21.	Online entertainment and web pages
V.	**Govern**
22.	Civic participation and participatory development
23.	Contact between citizen-government and intra-government communication
24.	*Special concern for preserving the organic character*
VI.	**Travel**
25.	Efficient traffic flow
26.	Use of alternative modes of transport
27.	*Competent water-based transportation*

- *Spiritual tourism economy*: as aforementioned, it is one of the unique features of Varanasi which needs to be examined for assessing its smart city potential.
- *Land river interface-based economy*: Varanasi offers a unique interface of river and land which augments its position as a city system. The ghats along the Ganges offer interesting economic vistas (allied industries to religious activities, cultural and creative industry) which will form an essential component in its smart city transformation.
- *Performing arts development*: this component will augment the economic and cultural quotient of the smart city transformation.
- *Spiritual knowledge dissemination and augmentation*: more emphasis should be laid in the organisation of spiritual language dissemination as it forms a unique feature of Varanasi.
- *Special concern for preserving the organic character*: Varanasi is a web of inter-connectedness and organic smartness. This character needs to be preserved while transposing it in smart city phenomenon.

- *Competent water-based transportation*: this particular sector of the city tends to be the untapped potential. It needs to be examined and utilised to its full potential for achieving smartness in the city.

7.7 Analysis: ISM

Interpretive structural modelling (ISM), a computer-assisted interactive learning process, is used to build a hierarchy for a set of elements connected by a contextual relationship. The technique has been used to configure the relationship (caters to) between the identified parameters for smart community planning. Through this technique this paper attempts to prioritise the elements and convert ambiguous mental model into a defined structural model (Sushil 2012; Zygiaris 2013).

Figure 7.2 shows the scanning method applied to obtain the reachability matrix. The process starts with the selection of an appropriate parameter as a pivotal element such that all other parameters can be uniformly distributed among the four sets: drop set (parameters which 'caters to' pivotal element), feedback set (parameters having a two-way relationship with pivotal element), non-feedback set (pivotal element 'caters to' these parameters) and vacancy set (parameters having no contextual relationship with pivotal element). The method is iterative, and after a few iterations, 'regional economy, community capital and self-help local organisations' were selected as pivotal element, and then other parameters were put into the most suitable set. Then, the reachability matrix was developed.

In the reachability matrix (Fig. 7.3), the column and row heads are the parameters identified and labelled with their serial numbers. The matrix is filled with 0s (no relationship) and 1s (relationship). In the relationship 'A caters to B', row heads are

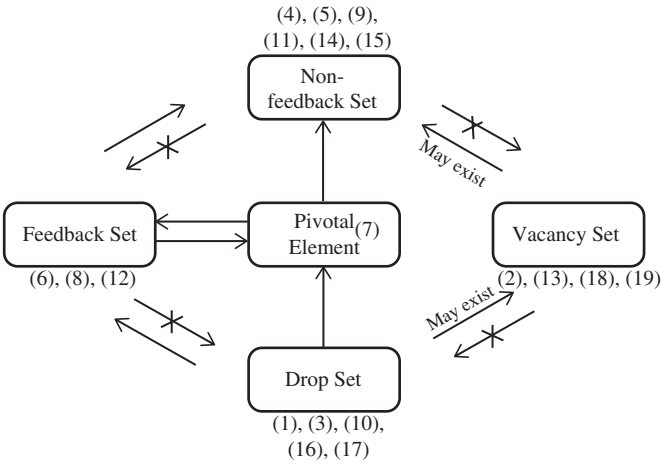

Fig. 7.2 Scanning method to develop reachability matrix (ISM) – generic

Reachability Matrix																				Reachability Set	Antecedent Set	Intersection Set	Level
	4	5	9	11	14	15	6	8	12	7	2	13	18	19	1	3	10	16	17				
4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4,5,6,8,12,7,1,3,10,16,17	4	1
5	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4,5,9,15	5,9,6,8,12,7,1,3,10,16,17	5,9	3
9	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	5,9,11,15	5,9,11,6,8,12,7,2,13,1,3,10,16,17	5,9,11	3
11	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	9,11,14,15	9,11,14,6,8,12,7,13,1,3,10,16,17	9,11,14	3
14	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11,14	11,14,15,6,8,12,7,13,1,3,10,16,17	11,14	1
15	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	14,15	5,9,11,15,6,8,12,7,2,13,1,3,10,16,17	15	2
6	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	4,5,9,11,14,15,6,8,12,7	6,8,12,7,1,3,10,16,17	6,8,12,7	4
8	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	4,5,9,11,14,15,6,8,12,7	6,8,12,7,1,3,10,16,17	6,8,12,7	4
12	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	4,5,9,11,14,15,6,8,12,7	6,8,12,7,1,3,10,16,17	6,8,12,7	4
7	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	4,5,9,11,14,15,6,8,12,7	6,8,12,7,1,3,10,16,17	6,8,12,7	4
2	0	0	1	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	9,15,2,13	2,10	2	5
13	0	0	1	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	9,11,14,15,13	2,13,2,10	13	4
18	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	18	18,19,1,3,16,17	18	1
19	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	18,19	19,1,3,10,16,17	19	2
1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	1	0	4,5,9,11,14,15,6,8,12,7,18,19,1,3,16	1,3,10,16	1,3,16	5
3	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	4,5,9,11,14,15,6,8,12,7,13,18,19,1,3,16,17	1,3,10,16	1,3,16	6
10	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	4,5,9,11,14,15,6,8,12,7,2,13,19,1,3,10,16,17	10,16,17	10,16,17	6
16	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	4,5,9,11,14,15,6,8,12,7,13,18,19,1,3,16,17	1,3,10,16,17	1,3,10,16,17	5
17	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0	0	1	1	1	4,5,9,11,14,15,6,8,12,7,18,19,10,16,17	3,10,16,17	10,16,17	5

Fig. 7.3 Reachability matrix and level assignment (ISM) – generic

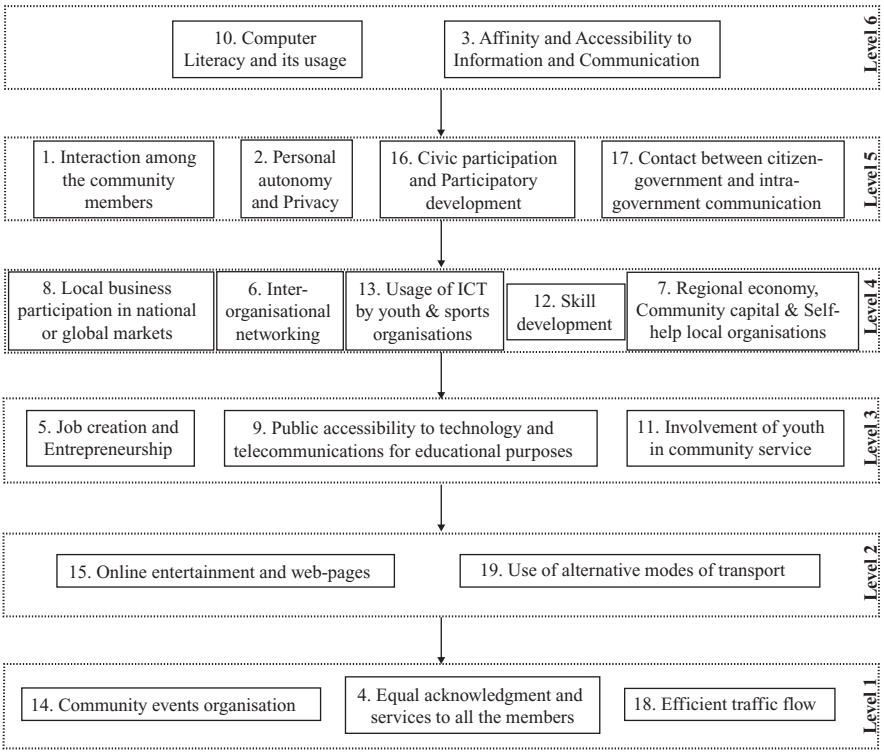

Fig. 7.4 Hierarchy model for smart community – generic

taken as A and column heads as B. Parts of the matrix are filled using transitivity and reflexivity concept. For instance, all elements in feedback loops will always lead to the elements of non-feedback loop, hence all 1s.

After assigning 0s and 1s, reachability set (elements reachable from A, 1s in row) and antecedent set (elements antecedent from A, 1s in column) are tabulated. Intersection set is further charted as intersection between both the aforementioned sets (Fig. 7.3). The parameter(s) with same elements in reachability and intersection set is assigned as Level 1. Then these elements are struck off from all the sets, and again using the same technique, the next level is assigned. The process continues until each parameter is assigned with a level. For generic parameters, six levels are obtained by applying ISM where Level 1 is the final level (Fig. 7.4).

7.8 Result: Hierarchy Model for Smart Community, Varanasi

The analysis of parameters (both generic and specific) resulted in the evolution of hierarchy models. These will help in prioritisation for initial point of action and resource allocation. The hierarchical model generated for the city of Varanasi

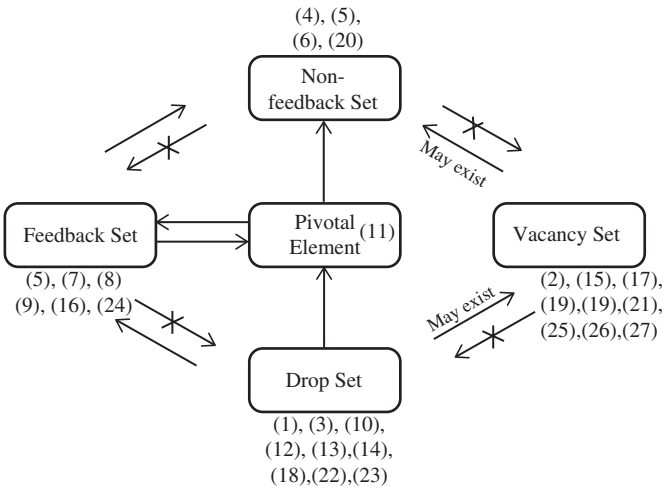

Fig. 7.5 Scanning method to develop reachability matrix (ISM) – Varanasi

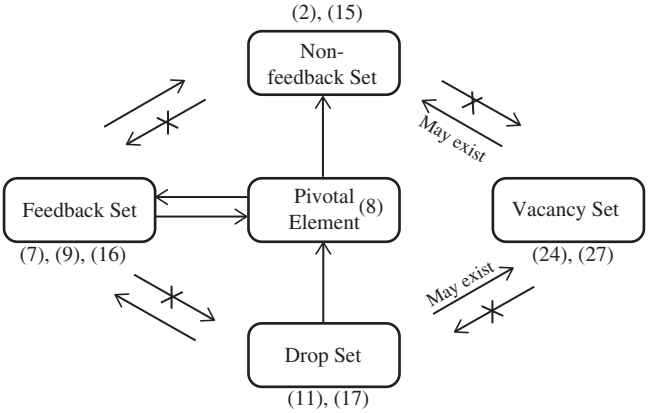

Fig. 7.6 Scanning method to develop reachability matrix (ISM) – subcomponent: Varanasi

includes 27 (19 generic and eight city-specific) parameters. It can be concluded from here that for smart city development, computer literacy, affinity to internet usage and access to information, is essential but only in combination with smart human networking and participatory development. It can be deduced from this model that after the aforementioned steps, policies can be channelised to boost land-river interface-based economy also. This should be followed by policies supplementing spiritual knowledge dissemination and augmentation and regularisation in spiritual tourism economy. The paper further proposes detailed development of structural models based on the already developed interpretive structural models.

For Varanasi-specific approach, 'creative economic systems' have been chosen as the pivotal element (Figs. 7.5 and 7.6). Initially seven levels were obtained (Fig. 7.7.). As Level 4 had ten elements in it, so the same technique was applied on those

	Reachability Matrix																															Reachability Set	Antecedent Set	Intersection Set	Level
	4	5	6	20	7	8	9	16	24	11	2	15	17	19	21	25	26	27	1	3	10	12	13	14	18	22	23								
4	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,5	4,6,7,8,9,16,24,11,1,3,10,12,13,14,18,22,23	4	2
5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	4,5,20,7,8,9,16,24,11,17,21,1,3,10,12,14,18,22,23	5	**1**
6	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,6	6,7,8,9,16,24,11,17,27,1,3,10,12,13,14,18,22,23	6	3
20	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,20	20,7,8,9,16,24,11,15,17,19,21,1,3,10,12,13,14,1,8,22,23	20	2
7	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,5,6,20,7,8,9,16,24,11	7,8,9,16,24,11,1,3,10,12,13,14,18,22,23	7,8,9,16,24,11	4
8	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,5,6,20,7,8,9,16,24,11	7,8,9,16,24,11,1,3,10,12,13,14,18,22,23	7,8,9,16,24,11	4
9	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,5,6,20,7,8,9,16,24,11	7,8,9,16,24,11,1,3,10,12,13,14,18,22,23	7,8,9,16,24,11	4
16	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,5,6,20,7,8,9,16,24,11	7,8,9,16,24,11,1,3,10,12,13,14,18,22,23	7,8,9,16,24,11	4
24	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,5,6,20,7,8,9,16,24,11	7,8,9,16,24,11,1,3,10,12,13,14,18,22,23	7,8,9,16,24,11	4
11	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,5,6,20,7,8,9,16,24,11	7,8,9,16,24,11,1,3,10,12,13,14,18,22,23	7,8,9,16,24,11	4
2	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2,19,21	2,14,18	2	4
15	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	20,15,17,19,21	15,17,19,1,3,13,14,18,22,23	15,17,19	4
17	0	1	1	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	5,6,20,15,17,21	15,17,19,1,3,13,14,18,22,23	15,17	4
19	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	20,15,17,19,21	2,15,19,21,3,14	15,19	5
21	0	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	5,20,19,21	2,15,17,19,21,1,3,13,14,22,23	19,21	3
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	25	25,26,27,1,3,12,13,22,23	25	1
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	25,26	26,27,1,3,12,13,14,22,23	26	2
27	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	6,25,26,27	27,3,12,22,23	27	4
1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	0	1	1	1	0	1	0	1	1	0	4,5,6,20,7,8,9,16,24,11,15,17,21,25,26,1,3,10,13,18,22	1,3,14,18,22	1,3,18,22	7
3	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	4,5,6,20,7,8,9,16,24,11,15,17,19,21,2,5,26,27,1,3,10,12,13,18,22,23	1,3,14,22	1,3,22	8
10	1	1	1	1	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	1	1	0	0	1	0	0	4,5,6,20,7,8,9,16,24,11,17,10,12,18	1,3,10,12,14,18,22	10,12,18	5
12	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	1	1	1	0	0	1	1	0	0	1	0	0	4,5,6,20,7,8,9,16,24,11,25,26,27,10,1,2,18	3,10,12,22	10,12	6
13	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	0	0	0	0	0	1	0	1	0	0	4,5,6,20,7,8,9,16,24,11,15,17,21,25,26,13,18	1,3,13,14,22,23	13	6
14	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	0	1	1	1	1	1	4,5,6,20,7,8,9,16,24,11,2,15,17,19,21,26,1,3,10,13,14,18,22,23	14,12,23	14,22,23	8
18	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	1	0	1	0	0	0	1	0	0	4,5,6,20,7,8,9,16,24,11,2,15,17,1,10,18	1,3,10,12,13,14,18,22	1,10,18	5
22	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	4,5,6,20,7,8,9,16,24,11,15,17,21,25,2,6,27,1,3,10,12,13,14,18,22,23	1,3,14,22,23	1,14,22,23	8
23	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	0	0	0	0	1	1	0	1	1	4,5,6,20,7,8,9,16,24,11,15,17,21,25,2,6,27,13,14,22,23	3,14,22,23	14,22,23	7

Fig. 7.7 Reachability matrix and level assignment (ISM) – Varanasi

Reachability Matrix											Reachability Set	Antecedent Set	Intersection Set	Level
	2	15	7	9	16	8	24	27	11	17				
2	1	0	0	0	0	0	0	0	0	0	2	2,7,9,16,8,11,17	2	1
15	0	1	0	0	0	0	0	0	0	0	15	15,7,9,16,8,11,17	15	1
7	1	1	1	1	1	1	0	0	0	0	2,15,7,9,16,8	7,9,16,8,11,17	7,9,16,8	2
9	1	1	1	1	1	1	0	0	0	0	2,15,7,9,16,8	7,9,16,8,11,17	7,9,16,8	2
16	1	1	1	1	1	1	0	0	0	0	2,15,7,9,16,8	7,9,16,8,11,17	7,9,16,8	2
8	1	1	1	1	1	1	0	0	0	0	2,15,7,9,16,8	7,9,16,8,11,17	7,9,16,8	2
24	0	0	0	0	0	0	1	0	0	0	24	24	24	1
27	0	0	0	0	0	0	0	1	0	0	27	27	27	1
11	1	1	1	1	1	1	0	0	1	0	2,15,7,9,16,8,11	11	11	3
17	1	1	1	1	1	1	0	0	0	1	2,15,7,9,16,8,17	17	17	3

Fig. 7.8 Reachability matrix and level assignment (ISM) – subcomponent: Varanasi

ten elements again (Figs. 7.6 and 7.8). Finally, ten levels are obtained for Varanasi (Fig. 7.9) where Level 1 is the final level.

7.9 Conclusion

Smart city as an urban experiment is a highly contextual and subjective especially in Indian scenario which will vary according to the identity, needs, potential and resources of the city. An attempt to formulate a generic model resulted in a level-wise emphasis in the realms of smart community planning parameters. The approach of ISM-based modelling helped in generating two simultaneous aspects, that of generic and specific cases. The generic case dealt with the parameters which would be common to any typical city which has to be transformed into a smart entity. The case of Varanasi was taken for generating specific model. This included all the parameters from the generic model and those criteria which are attributed to the uniqueness of this city and will make an impact while decision-making in the planning procedures.

Policy wise, it could be implied from above that ‘smart community planning’ should be the foremost step in making our cities smart and everything else follows it. This would result in policies which will integrate people centric approach with smart solutions to achieve the desired result. Another important component which would be vital to the process is intra-government synchronisation and citizen-government coordination.

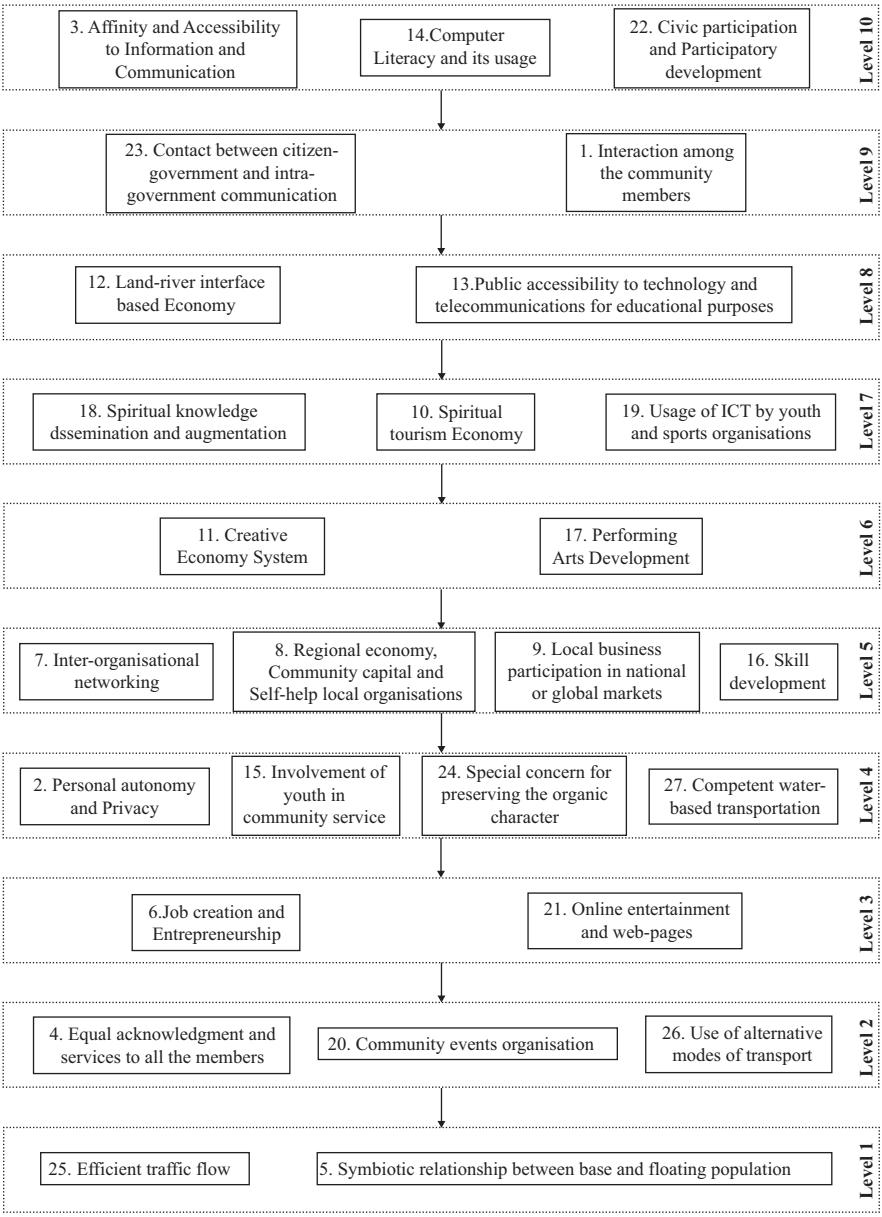

Fig. 7.9 Hierarchy model for smart community – Varanasi

References

Cosgrave E, Tryfonas T (2012) Exploring the relationship between smart city policy and implementation. In: SMART 2012: the first international conference on smart systems, devices and technologies, pp 79–82

Giffinger R, Fertner C, Kramar H, Kalasek R, Pichler-Milanovic N, Meijers E (2007) Smart cities—ranking of European medium-sized cities (Report). Vienna University of Technology. [online]. Available at: http://www.smart-cities.eu/download/smart_cities_final_report.pdf. Accessed 20 Mar 2015

Hollands R (2008) Will the real smart city please stand up? City 12(3):303–320

http://www.smartcommunities.org/guide/index.html. Accessed 23 Mar 2015

International Business Times (2013) World population to increase to 9.7B by 2050; India will overtake China as most populous nation: new study. [online]. Available at: http://www.ibtimes.com/world-population-increase-97b-2050-india-will-overtake-china-most-populous-nation-new-study-1413620. Accessed 18 Mar 2015

Mattoni B, Gugliermetti F, Bisegna F (2015) A multilevel method to assess and design the renovation and integration of Smart Cities. Sustain Cities Soc 15:105–119

Newman PWG (1999) Sustainability and cities: extending the metabolism model. Landsc Urban Plan 44(4):219–226

Rios P (2008) Creating "The Smart City". [online] Available at: http://archive.udmercy.edu:8080/bitstream/handle/10429/393/2008_rios_smart.pdf?sequence=1. Accessed 21 Mar 2015

Sushil (2012) Interpreting the interpretive structural model. Global J Flexible Syst Manage 13(2):87–106

Taewoo N, Theresa AP (2011) Conceptualizing smart city with dimensions of technology, people, and institutions. In: Proceedings of the 12th annual international digital government research conference: digital government innovation in challenging times, pp 282–291

Washburn D, Sindhu U, Balaouras S, Dines RA, Hayes NM, Nelson LE (2010) Helping CIOs understand "smart city" initiatives: defining the smart city, its drivers, and the role of the CIO. Forrester Research, Inc., Cambridge, MA

Weisi F, Ping P (2014) A discussion on smart city management based on meta-synthesis method. Manage Sci Eng 8(1):68–72

Zygiaris S (2013) Smart city reference model: Assisting planners to conceptualize the building of smart city innovation ecosystems. J Knowl Econ 4:217–231