Chapter 18
International Collaborative Research: Smart Metropolitan Regional Development: Economic and Spatial Design Strategies and Conclusions of Cities Case Studies

T. M. Vinod Kumar

Abstract This chapter has two parts. In the first part, the organizational details of the international research collaborative project "Smart Metropolitan Regional Development: Economic and Spatial Design Strategies" is discussed, in the second part are presented in consultation with the team leaders of the city study, and their general conclusions of the study.

Keywords Organization study · Results

18.1 Smart Metropolitan Regional Development: Economic and Spatial Design Strategies

The Smart Metropolitan Regional Development energises, reorganises and transform the legacy economy to smart economy embracing ICT, creating sustainable zero marginal cost society, triggering sharing economy, designing the five pillars of the third industrial revolution by smart communities and so on. The state of the art of Smart Economy in Smart Cities has been documented by Springer, (edited by T. M. Vinod Kumar) in 2016 using in depth 13 city case in Ottawa, St. Louis, Stuttgart, Bologna, Cape Town, Nairobi, Dakar, Lagos, New Delhi, Varanasi, Vijayawada, Kozhikode and Hong Kong studies from ten countries namely Canada, China, Germany, India, Italy, Kenya, Nigeria, Senegal, South Africa and USA by about 50 authors. This book applies the experiences of these cities for Smart Metropolitan Development using the design of economic and spatial strategies. This

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is undertaken by a series of case studies leading to finally drawing conclusions about this concept. This task is attempted largely by universities located in the US, Europe, Africa and Asia.

These 16 city studies conducted in this book start with a state of the art study of the growth of metropolitan cities around the world which includes meta cities of 20 million population and above, mega cities of 10 million and above and metro cities of one million and above of urban agglomerations. This is followed by an appraisal of economic and spatial design strategies used by the official plans of 17 cities both from the east and the west. Finally, the major conclusion drawn from the book is summarised in this concluding chapter after discussing the organisation of this international research program.

Smart Metropolitan Regional Development can be conceived and developed emphasizing some total of integration of internet of enabling ICT technologies for smart economic development, embracing an economy of production and distribution in a carbon neutral environment monitored in real time transportation system that performs intelligent and smart mobility based on real-time information drawn from big data for the Smart Economy. Some can think of re-embracing capitalism that can create. Smart Metropolitan Regional Development, or others can think of going after socialism or communism with a command economy and an ever-growing bureaucracy to implement socialism or communism. The reality, however, points towards a different direction. The authors of this book have adopted only one simple and dependable way of looking at Smart metropolitan city economic development and governance through smart activation of Smart People. Smart People need not embrace Capitalism since they have found that without much capital, not owning a brick and motor store, or a mall, they can be part of Amazon or eBay seller which is the biggest market place in the world sharing the ICT-enabled marketing and logistic system at low marginal cost and price. In the same way, they can also be a part of the largest taxi services like Uber with only one taxi at his disposal while Uber does not own even one taxi defeating the central concept of Capitalism. Since Uber just provides location based computer and smart phone platform it does not have a huge and very expensive (with very limited benefit) bureaucracy that dictates movements unlike Socialism and Communism. Since real-time information and big data guide all these economic activities, socialism and its consequent ills of proliferating and expensive bureaucracy for tax payers with no value addition to the urban economy are no use for the Smart metropolitan city economic development. During the colonialism era, everything about life was centred around the bureaucrats of the colonialist. Even when many countries became free from colonialism this dependency on bureaucracy was evident as if bureaucrat regulator can give leadership to economic development which by the very job of the bureaucrat cannot when the democratic republic is run by people. At best, he can implement policies of the elected government enshrined in legislations in close cooperation with people. This does not mean any regulation or no law and order in Smart

Economy. Like tax compliance by electronic filing of income and wealth tax, Smart Governance is there to replace age old and dysfunctional bureaucracy enshrined in a brick and motor building in a prominent place in the city, a legacy of the sixteenth century in many colonial countries. We consider Smart People and smart community and their E-democracy as all powerful and capable building blocks of Smart Cities for Smart Economic development replacing capitalism and socialism at one go. For Smart People, there should be opportunities in Smart Cities for continuing training Smart People to make them smarter today compared to yesterday. Smart People can be everyone in a city irrespective of their wealth, educational qualification and social background and, therefore, an inclusive concept since all of them have a constructive role to play in Smart Cities. They can be below the poverty level or above, which does not matter but all of them should have the wish to be Smart People and can be part of never-ending learning mode to be smart. Smart People through their E-Democracy and E-Governance plan, design and govern the Smart Cities. Smart People are the creators, governors, regulators, managers and maintainers of Smart Metropolitan Regional Development. The required Smart Cities technologies which are ICT-enabled can easily be designed by Smart People's creativity, and prototypes are made in Fabrication Laboratory (Fab Lab) if located in Smart Cities for mass production and use. Being the creators of the Smart metropolitan city technologies, Smart People can maintain, repair, innovate and evolve the existing technologies to more cost-effective and functionally superior, next generation technologies which can be shared profitably with other smart cities. No one is running away from Smart People's creation and redevelopment of next generation Smart metropolitan city technologies.

18.2 Inter Related International Collaborative Research Projects on Smart Cities

This book is the fifth in a series Professor T. M. Vinod Kumar conceived, coordinated, implemented and edited about articulating the various roles of Smart People in Smart Cities.

The first book entitled "Geographic Information System for Smart Cities" edited by him [1] was aimed at creating a comprehensive self-awareness of city functioning every second and every day in real time which is the foundation of Smart metropolitan city. Geospatial technologies, sensors and analytics can be used to reach the awareness and use it in real time for various types of use by Smart People. How it can be used for a variety of urban issues commonly observed globally is what that book is all about.

These Smart People thereby progress towards their self-directed goals, such as they demand Smart Living and Smart Economic Development. They aspire to the

highest level of quality of life in a Smart metropolitan city environment which they can very well afford and can expand many folds the economic development opportunities to satisfy higher income and employment needs to sustain Smart People. No smart person in a city is an island or elite, but they share a common destiny and common urban space, urban realm, and social and physical infrastructure. Government as the regulator is required that none of the Smart People is denied of all city provides for irrespective of their income level and social status or they are above or below the poverty level. Hierarchy of government exists in a city, but their governance needs to be for a Smart metropolitan city that is fully aware of itself every second and as against Government who comes to know about the issue when a case is filed in the court which takes many decades to get a final judgement. The existing governance systems are obsolete being a product of sixteenth century or earlier designed for colonial rulers, built on the model of East India Company's administration in India for a sixteenth century which cannot be used or Smart metropolitan city economic development. However, those who aspire to live in Smart Cities are in the twenty-first century and no more part of an exploitative empire under the iron hand of a colonial administrator. Therefore, the twenty-first century Smart Cities require Smart metropolitan city e-governance system that was the subject matter of the second book entitled "E-Governance for Smart Cities" [2].

The third book in this series is, "Smart Economy in Smart Cities" [3]. This book explores possibilities for rapid change in the income level and employment opportunities of those Smart People below or above the poverty level in a Smart metropolitan city, and to make the NDP growth rate to a desired higher level consistently for the next many decades. Then, the current trend of urban local economic development is required to be converted to Smart metropolitan city Economic Development. For example, 10% NDP growth rate envisaged for next three decades in India and many other countries can only be realized through Smart metropolitan city Economic Development. Smart Cities and the related conceptualization boasts of the Smart Economy but not much has been systematically researched or documented about it so far. This calls for a study of many cities across the world to document what constitutes a Smart Economy. There are two groups of cities being studied in this book. Some of them have been designated as Smart Cities by learned societies, but others are not but aspire to be Smart Cities. These call for different approaches to research design and studies. It was seen from case studies both these cases in differing countries emphasize different approaches, establishing that there are no cook book solutions. The cities being studied in this book are spread in several major continents and regions, including North America, Europe, Africa, Indian subcontinent and East Asia. They are Ottawa in Canada; Stuttgart in Germany; Bologna in Italy; Dakar in Senegal; Lagos in Nigeria; Nairobi in Kenya; Cape Town in South Africa; New Delhi, Varanasi, Vijayawada, and Kozhikode in India; Hong Kong in China, Cape Town, Dakar, Nairobi and Lagos in Africa.

The fourth book in this series is "E-Democracy for Smart Cities" [4]. The world over, participatory democracy is worshipped and preached but what is practised is representative democracy at the city level and beyond. It is believed that in meta cities, megacities and metropolitan cities, only representative democracy with elected representatives will work. However, democracy practised in small cities like Athens in Greece, Licchavi in India in ancient times and many parts of the world documents face-to-face democracy in practice. In these cities, everyone in a city sat together and jointly decided on all aspects of the city. Citizens not only participated in decision making but acted together as one government and even as administrator and regulator. With the advent of ICTs in Smart Cities of the twenty-first century, it is possible to go back to the face-to-face democracy that, by any measure, is much superior to representative democracy. The fourth book is all about E-Democracy in Smart Cities in action. It is divided into three parts, State of the Art Surveys, Domain Studies and Tools and Issue of E-Democracy in Smart Cities.

The fifth book in the series is this book" Smart Metropolitan Regional Development: Economic and Spatial Design Strategies" edited by T. M. Vinod Kumar and published by Springer-Nature. Here metropolis also includes meta cities with 20 million and above population, mega cities with 10 million and above population and metro cities with one million and above. Here these cities however large these cities may be, need to be converted to smart metropolis using the specific design of economic and spatial strategies. The city studies for the "Smart Metropolitan Regional Development" result in many insights on many smart spatial and economic strategies using Internet of Things, Internet of Democracy and Internet of Governance oriented to the specific issue of a town and its potential; taking into consideration that the Smart metropolitan city is an integrated six systems in which Smart Economy is an integral part. It can relate to Smart Mobility, Smart Environment or Smart Living. Vinod Kumar has discussed the Smart metropolitan city System in the first chapters of four books already published [1–4] and dealt with it further in Chap. 1 of this book. Based on the elaboration of Smart metropolitan city System, if one must develop city-, region or country-specific economic and spatial design strategies for a Smart metropolitan city, it must be designed based on local ecological and cultural system of the city and not a type universal design. Location-specific and culturally acceptable economic and spatial strategies can be locally evolved, governed and managed. This is the only way local culture will find expression in Smart metropolitan city economic and spatial strategies by utilizing local, creative talents of smart people in many institutions in Smart Cities. There are 16 cities (Fig. 18.1) being studied in this project namely Pittsburgh in USA, Stuttgart in Germany and Naples in Italy, Dakar in Senegal, Conakry in Guinea, Abuja in Nigeria, Johannesburg in South Africa and Nairobi in Kenya, Ahmedabad-Gandhi Nagar, Bangalore, Chandigarh, Jaipur, Kozhikode, New Delhi, Surat in India and Hong Kong and greater Pearl River Delta Region from China.

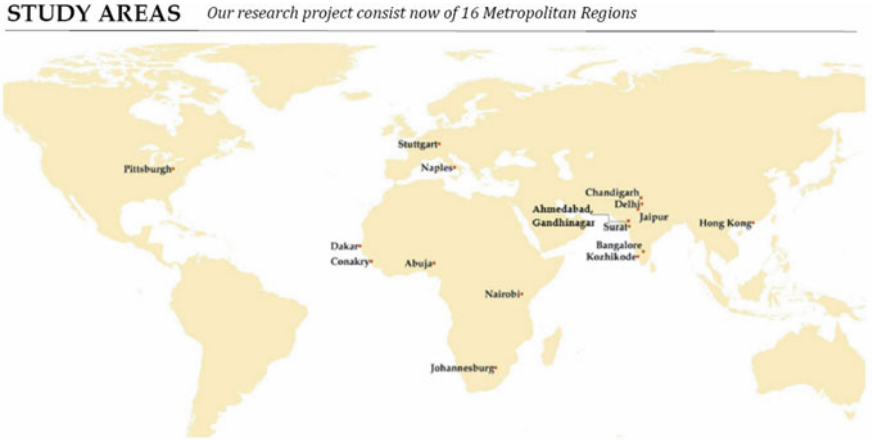


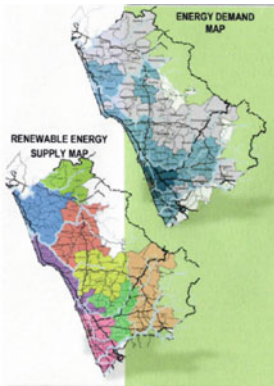
Fig. 18.1 Participating metropolitan areas for "smart metropolitan regional development: economic and spatial design strategies"

The sixth book in this series edited by T. M. Vinod Kumar will be published in 2019 by Springer-Nature is entitled "Smart Environment for Smart Cities" as a product of international collaborative research. This book, is aimed at developing the Design and Protocol and Practice of Smart Environmental Resources Management for Smart Cities. Environment Resources are common proprieties where an active role of Government and People are required and hence its management is a joint and synchronous effort of E-Democracy, E-Governance and IOT system in a 24 h 7-day framework on any environment resource in any smart cities. The smart environmental resources management is a practice that uses information and communication technologies, Internet of Things, Internet of Governance (E-Governance) and Internet of People (E-Democracy) along with conventional resource management tools to realise the coordinated, effective and efficient management, development, and conservation that improves ecological and economic welfare in an equitable manner without compromising the sustainability of development ecosystems and stakeholders. This book will present many city case studies (Nova Scotia in Canada, Hog Kong in China, Ahmedabad, Gandhi Nagar, Chandigarh, Kozhikode, New Delhi, Patna, Surat, Gurgaon from India, Rome in Italy, Yokohama in Japan, Nairobi in Kenya, Ibadan in Nigeria, Bangkok in Thailand, and Dubai in UAE), is centred on one or all environmental resource each in a city.

18.3 The Fifth Book on Smart Metropolitan Development

The editor and coordinator of the book series T. M. Vinod Kumar and many authors who participated in the earlier four books felt that there is a gap in knowledge about Smart Metropolitan Regional Development as far as large metropolises, mega cities and meta cities are concerned. Instead of converting a part of the city to smart metropolitan city, is it feasible to transform a 20 million plus population meta city by design and implementation of economic and spatial strategies? Yokohama in Japan started in a piece meal manner like any smart metropolitan city but now it is a total smart metropolitan city project on their own. This is at a juncture when the smart metropolitan city is developed for a very small part of large meta city like New Delhi Municipal Committee area as if it is an urban design project. Indeed, it is the duty of each country to fill in this gap at near zero marginal cost so that research is sustainable. Universities have a responsibility to conduct the research to fill in the gap. This can only be done with a year-long and in-depth study of selected cities around the world. No attempt was made to make a stratified sample of such cities the world over, and these city studies do not represent the universe of such large "smart" cities. We believe that each city is unique but the experience of dealing with Smart metropolitan city regional development in many cities world over can be of use to aspiring Smart Cities to a certain extent anywhere. We also believe that no city can copy the experience of another city or clone another Smart metropolitan city regional development practice since every city is a unique sociocultural, ecological and economic system.

Funding for such collaborative research project was another issue. Universities and research centres dominated in collaborating these six-smart metropolitan city research projects. We also found that along with Universities, some not-for-profit national and international networks and institutions, city governments and regional governments in certain countries also came forward to participate in this collaborative research programme. The editor and coordinator of the project again felt that this international project shall not seek any external funding other than the internal resource mobilization from within the participating universities. He could convince all participating institution on this. For this book National Institute of Technology, Calicut (NIT-C) came forward to help in an international Research Consultative meeting on Smart Metropolitan Regional development: Economic and Spatial Design Strategies. This activity was co coordinated by Firoz Mohammed and Bimal of the Department of Architecture and Planning, NIT-Calicut. The total expenditure of the International Consultative Committee meeting was a share between NIT C and participant researchers. While NIT-C supported all expenditure within Calicut City, the other expenditure was met by researchers/authors. Those who could not visit NIT Calicut were provided with a facility for video conferencing thereby saving on travel and time cost.



International Consultative Meeting on "Smart Metropolitan Regional Development: Economic and Spatial Design Strategies"

17th & 18th December 2016

Department of Architecture and Planning
National Institute of Technology Calicut

"Smart Metropolitan Regional Development: Economic and Spatial Design Strategies"

Preamble

Around **50** Authors from **10** countries worked in **13** cities for **2** years to produce a book.

"Smart Economy in Smart Cities": An International Collaborative Research: Ottawa, St.Louis, Stuttgart, Bologna, Cape Town, Nairobi, Dakar, Lagos, New Delhi, Varanasi, Vijayawada, Kozhikode, Hong Kong" (2016: Springer)

A few participants felt the need to share the practices of **Smart Economic and Spatial development** of these 13 cities to other cities by preparing **Metropolitan Regional Development Plans** as Models using the experiences of each city as relevant to the city in consideration.

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Objectives

The objective of this consultative meeting is a follow-up of ideas expressed in the Preamble. Here the status of any Metropolitan region shall be presented and a methodology to work out a study shall be discussed in the consultative meeting.

International Consultative Meeting on "Smart Metropolitan Regional Development: Economic and Spatial Design Strategies"

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Smart Economy
"Sharing Economy"

Invitees:

Invitees are the study teams across the world who agreed to work on the theme 'Smart Metropolitan Regional Development: Economic and Spatial Design Strategies' with representations from different continents like Asia (8), Africa (6), Europe (3) and North America (1). This constitutes 19 universities and 2 research organisations.

Duration of the Research:

Two Semesters: One in the field and another to document by teachers of the teamwork that will eventually be published as a book.

Participation in the meeting:

It is expected that the entire team shall be participating in this two days' deliberation. Video conferencing facilities shall be made available to those participants who are not able to visit National Institute of Technology Calicut for the deliberation and they may participate live from their respective cities/countries.

Fund Sharing:

Smart Economy is a '**Sharing Economy**' and this Consultative Meet shall share all the expenses. National Institute of Technology Calicut shall meet all the expenses within the campus (such as local conveyance and food and accommodation for the participants) and the participants shall bear off-site expenses.

Venue:

Department of Architecture
National Institute of Technology Calicut

Date:

17th & 18th December 2016


INTERNATIONAL RESEARCH CONSULTATIVE MEETING
ON
SMART METROPOLITAN REGIONAL DEVELOPMENT :
ECONOMIC AND SPATIAL DESIGN STRATEGIES
17 12 2016 13:43


INTERNATIONAL RESEARCH CONSULTATIVE MEETING
ON
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ECONOMIC AND SPATIAL DESIGN STRATEGIES
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Time Slots for International Research Consultative Meeing

	Slots	Presenting Team (Please book your slot here)	Mode of presentation	Hong kong/China +8	Thailand +7	India +5:30	Kenya - Naerobi +3	Nigeria +1	Germany +1	Italy +1	Spain +1	Guinea +0	Senegal - Dakar +0	Liberia - Monrovia +0	Florida -5	Canada - Toronto -5	Columbia - South Africa -5
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	2	Calicut - India	Physical	08:15	15:15	13:45	11:15	09:15	09:15	09:15	09:15	08:15	08:15	08:15	03:15	03:15	03:15
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	3	Calicut - India	Physical	09:00	16:00	14:30	12:00	10:00	10:00	10:00	10:00	09:00	09:00	09:00	04:00	04:00	04:00
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	4	Surat - Gujrat - India	Video	09:45	16:45	15:15	12:45	10:45	10:45	10:45	10:45	09:45	09:45	09:45	04:45	04:45	04:45
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	5	Refreshment Break	Refreshment Break	10:30	17:30	16:00	13:30	11:30	11:30	11:30	11:30	10:30	10:30	10:30	05:30	05:30	05:30
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	6	SPA Bhopal - India	Video	11:15	18:15	16:45	14:15	12:15	12:15	12:15	12:15	11:15	11:15	11:15	06:15	06:15	06:15
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	8	Naples - Italy	Physical	12:45	19:45	18:15	15:45	13:45	13:45	13:45	13:45	12:45	12:45	12:45	07:45	07:45	07:45
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	9	Concluding Discussions	Video/Physical	13:30	20:30	19:00	16:30	14:30	14:30	14:30	14:30	13:30	13:30	13:30	08:30	08:30	08:30
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	15	* Dakar -	Physical	08:15	15:15	13:45	11:15	09:15	09:15	09:15	09:15	08:15	08:15	08:15	03:15	03:15	03:15
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	21	*Nairobi	Physical	12:45	19:45	18:15	15:45	13:45	13:45	13:45	13:45	12:45	12:45	12:45	07:45	07:45	07:45
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	BREAK						DINNER BREAK										
	23	* Conakry	Physical	14:45	21:45	20:15	17:45	15:45	15:45	15:45	15:45	14:45	14:45	14:45	09:45	09:45	09:45
				15:30	22:30	21:00	18:30	16:30	16:30	16:30	16:30	15:30	15:30	15:30	10:30	10:30	10:30
	24	Buffer	Buffer	15:30	22:30	21:00	18:30	16:30	16:30	16:30	16:30	15:30	15:30	15:30	10:30	10:30	10:30
				16:15	23:15	21:45	19:15	17:15	17:15	17:15	17:15	16:15	16:15	16:15	11:15	11:15	11:15
	25	Jaipur - India	Video	16:15	23:15	21:45	19:15	17:15	17:15	17:15	17:15	16:15	16:15	16:15	11:15	11:15	11:15
				17:00	00:00	22:30	20:00	18:00	18:00	18:00	18:00	17:00	17:00	17:00	12:00	12:00	12:00
	26	Concluding Discussion	Video/Physical	17:00	00:00	22:30	20:00	18:00	18:00	18:00	18:00	17:00	17:00	17:00	12:00	12:00	12:00
				17:45	00:45	23:15	20:45	18:45	18:45	18:45	18:45	17:45	17:45	17:45	12:45	12:45	12:45

* No request from team - Assigned by organizers

\# Alternate slot proposed by organizers

18.4 Design of the Collaborative Research Programme

Research Collaborations worked out is purely voluntary and no financial support that binds a project together. Since collaborators are universities, Government, research institutions, professional networks and not-for-profit associations from Asia, Europe, Africa and America, complete independence for pursuing the research was there, free of the baggage of ideologies of granting organisation. They need not accept existing smart cities policies of study cities in their research. Coordinator Editor of the project has no financial or administrative control over any institution participating in the project since he was not in receipt of any grants and did not distribute it. Typologies of the institutions involved in this international project are given in Fig. 18.2. All these autonomous institutions are guided by the highest standard of scholarship and timely completion of research and publication.

18.5 Research Questions on Smart Metropolitan Regional Development

The kind of collaboration in this international research project requires that all participating institutions shall formulate their own research questions and research the methodology which is of use to the country where these study cities are located. Depending upon the type of city some of which are leading Smart Cities, and some are not Smart Cities, the approaches must differ?

However, the paucity of empirical evidence on Smart Metropolitan Regional Development using economic and spatial strategies opens a new area of research: What strategy intervention brings about Smart Metropolitan Regional Development? This is the central focus of the book.

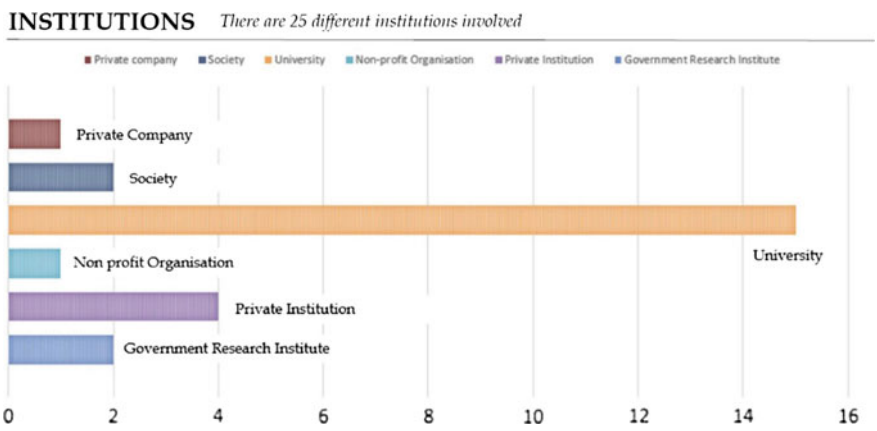


Fig. 18.2 Typologies of research institutions participating in this book

Do cities awaken social, cultural development and ecological (environmental) management through smart metropolitan development? This question lies at the heart of the proposed international collaborative research programme, and unpacking it gives us four interrelated research questions, as follows:

I. What constitutes Smart Metropolitan Development? This will need identification of the key ingredients and their role in making Smart Economic and Spatial changes in Smart Cities.
II. What changes Smart Metropolitan Regional Development brings to social development, cultural preservation, heritage conservation and ecological management? This calls for understanding the inter-linkages between Smart Economy in Smart Cities on one hand, with social development, cultural preservation, heritage conservation and ecological management on the other.
III. How and what processes facilitate the changes to the smart metropolitan region? Do cities bring to social development, cultural preservation, heritage conservation and ecological management? These may include:

    (a) innovation–diffusion (by ICTs and other modes),
    (b) spatial planning,
    (c) sectoral planning (including economic, social development, cultural preservation and ecological management),
    (d) heritage conservation and management plan and
    (e) institutional and governance processes, among others.

IV. How and what changes can be brought to improve the processes to achieve improved/optimal results? These changes related to the various processes as mentioned in Research Question iii.

A deeper understanding of changes in the social, cultural and ecological system of the Smart metropolitan city with the advent of Smart Economy and Smart People for smart metropolitan development is the focus of study. This research programme and the institutions selected for this purpose as academic collaborators are an effort to address this research gap.

18.6 Scope of Research

The following outlines the areas that may be covered when conducting research under the "Smart Metropolitan Regional Development" programme. This is an indication only, and it is left to the team to decide what is appropriate.

I. A time series study of changes in the urban economy by sectors and identifying distinct features of evolving to Smart Economy.
II. Study of theories of local economic development and smart economic development at metropolitan world city level and modelling for study city.

III. Study of the multi nuclei spatial organization of evolving city in comparison with envisaged spatial organization given by the Master Plan.
IV. The concept of accessibility in the Master Plan and its changes with respect to increasing use of ICT in Smart Cities.
V. Changing needs for spatial access in a Smart Metropolitan Economy for goods and services with an increase in the use of ICT and consequent changing needs.
VI. Changing the role of the hierarchy of service areas in a Smart Metropolitan Economy in a Smart metropolitan city as influenced by increasing use of ICT.
VII. Evolving structure of metropolitan urban agglomeration and changes required in a Smart metropolitan city.
VIII. Evolving structure of cities in urban agglomeration and changes required in view of the increase in the use of ICT.
IX. Change of spatial standards in a Smart metropolitan city.
X. Changes required in zonal policies and plans.
XI. Study of legislation of Metropolitan Planning Committee (for instance, in India) and suggest changes as per special requirement of Smart metropolitan city.
XII. Change of role of community-based organizations (for example, Residential Associations in India) in a Smart metropolitan city with an increase in the use of ICT.
XIII. Change of role of Ward Committee in a Smart metropolitan city with an increase in the use of ICT.
XIV. Change of role of Municipal Council in a Smart metropolitan city with an increase in the use of ICT.
XV. Change of role of Metropolitan Planning Committee in a Smart metropolitan city with an increase in the use of ICT.

Note: The scope of research can be further elaborated by the collaborating institutions but need not be uniform for all study cities. Each department of university participating in this research programme shall incorporate relevant Smart Metropolitan Development features appropriate to the goals for each department. The coordinator of this project does not intend to dictate the direction of the research and have a diverse group of collaborating universities, and they should orient their study strictly based on academic goals of their department.

18.7 Study Metropolitan Regions

The Metropolis will be selected as study area by each of the collaborating universities independently, which will be the place the one-year and two-semester combined effort to conduct this research. Universities participating in this programme adopted different types of collaboration. Some universities used, their

doctorate and post-doctorate students, while others used students at masters and first professional degree level. A post-doctoral student in the department can work on a narrow subject area in the study as individual work. While graduate and undergraduate students can work on design solutions for the Smart Metropolitan Regional Development, Research institutions can charter their own strategic areas of research.

18.8 Project Details

The Smart Metropolitan City will be selected as study area by each of the collaborating universities independently, which will be the place the one-year and two-semester combined effort to conduct this research. Universities participating in this programme adopted different types of collaboration.

The project details of the study city are given in Table 18.1.

18.9 Way of Working the Programme

18.9.1 Integrating Smart Metropolitan Regional Development Research with Academic Programmes

This international collaborative research programme, with the participation of 10 countries and 16 study cities as tabulated above was conducted by many diverse university departments, research institutions and others as shown in the graph and table above. In Smart Metropolitan Regional Development, the basis of smart metropolitan development, work, place of work, nature of economic activities in work place, carrying capacity of economic activities, livelihood and income are not variable that can be studied only by Department of Economics alone. Purposefully, we did not enlist department of economics in this study. Authors feel that GDP rate will be considerably higher in Smart Cities, and it will be computed periodically by respective cities and/or nations using the country's economic and statistics infrastructure. Therefore, there is no need for a computational study for Smart metropolitan city economic variables and modelling by this research programme. For the conventional economist, the place does not matter but for land economists, regional planners, urban planners, landscape architects and applied scientists, success and failure of economic activities depend on upon the location, local resources, place and people. For example, heritage tourism depends on the character of heritage and economic activities that can be woven around it and for ecotourism it is the ecology of the area and tourism that is within the carrying capacity of the ecosystem. The conventional macroeconomist lacks such perspective and capacity to develop such areas. In fact, there is no department of economics participating in

Table 18.1 Project details

S No.	Study metropolitan regions	Countries	Authors	Institutions
1.	Dakar	Senegal	Dr. Gora Mboup	Global Observatory Linking Research to Action (GORA), New York, USA
			Dr. Mame Cheikh Ngom	University Cheikh Anta Diop (UCAD), Dakar, Senegal
			Cheikhou Balde	Municipal Development Agency (ADM), Dakar, Senegal
			Mandiaye Ndiaye	Ministry of Urban Renewal, Housing and Living Environment (Ministere du Renouveau Urbain, de l'Habitat et du Cadre de Vie), Dakar, Senegal
2.	Conakry	Guinea	Dr. Gora Mboup	GORA Corp, New York, USA
			Ibrahima Camara, Nene Mariama Balde	City and Territorial Management Ministry (Ministere de la Ville et de l'Amenagement du Territoire), Guinea, Conakry
			Khalil Fofana	GORA Corp, Toronto, Canada
			Mustafa Sangare	GORA Corp, Washington DC (USA)
3.	Abuja	Nigeria	Prof. Femi Olokesusi Dr. Femi Aiyegbgajeje Ibitayo Modupe Arije	Afe Babalola University, Ado-Ekiti, Nigeria University of Ibadan, Nigeria UN-Habitat, Nigeria
4.	Nairobi	Kenya	Dennis Mwaniki Romanius Opiyo Daniel Githira Keziah Mwang'a	GORA Corp, Nairobi, Kenya University of Nairobi, Kenya Consultant, Nairobi, Kenya Gran Sasso Scientific Institute, Italy

(continued)

Table 18.1 (continued)

S No.	Study metropolitan regions	Countries	Authors	Institutions
5.	Johannesburg	South Africa	Gora Mboup	GORA Corp, New York, USA
			Paida Mhangara, Naledzani Madau	South African National Space Agency (SANSA), Tshwane, South Africa
6.	Stuttgart	Germany	Michael Hertwig, Manfred Dangelmaier, Joachim Lentes, Satyendra Singh, Nikolas Zimmermann	Fraunhofer Institute of Industrial Engineering University of Stuttgart, Institute of Human Factors and Technology Management University of Applied Sciences Stuttgart
7.	Naples	Italy	Dr. Antonio Caperna, Cerreta Maria, Eleni Trscada, Guglielmo Minervino, Roberta Mele, Giuliano Poli Elina Alatalo	Department of Architecture (DiARC), University of Naples "Federico II", Italy College of Engineering and Technology, University of Derby (UK) International Society of Biourbanism, School of Biourbanism and Design, Italy Università Mediterranea, Italy Tampere University, Finland
8.	Pittsburgh	USA	Dr. Sudeshna Ghosh, Dr. Calvin Maselala, Dr. Sweta Byahut	Indiana University of Pennsylvania, Aurburn University
9.	Hong Kong	China	Dr. Sujata Govada, Tim Rogers	School of Architecture, Chinese University of Hong Kong, Institute for Sustainable Urbanization
10.	Ahmedabad-Gandhinagar	India	Prof. Jignesh G. Bhatt Dr. Omkar K. Jani	Dharmsinh Desai University (DDU), Nadiad—387001, Gujarat, India Gujarat Energy Research and Management Institute (GERMI), Gandhinagar—382007, Gujarat, India

(continued)

Table 18.1 (continued)

S No.	Study metropolitan regions	Countries	Authors	Institutions
11.	Bangalore	India	Amit Chatterjee, Binayak Choudhury, Premjeet Dasgupta, Gaurav Vaidya	School of Planning and Architecture, Bhopal
12.	Jaipur	India	Prof. H. B. Singh Dr. Prabh Bedi Dr. Neha Gupta	School of Planning and Architecture, New Delhi
13.	Delhi	India	Prof. Ashok Kumar et al.	School of Planning and Architecture, New Delhi
14.	Kozhikode	India	Prof. T. M. Vinod Kumar, Dr. C Mohammed Firoz, Nmrata Radhakrishnan	National Institute of Technology, Calicut
15.	Surat	India	Bhasker Vijaykumar Bhatt, Dr. Leena Garg, Dr. Krupesh A. Chauhan	Sarvajanik College of Engineering and Technology, Surat Bhagwan Mahavir College of Architecture and Planning, Surat SV National Institute of Technology, Surat
16.	Chandigarh	India	Asfa Siddiqui KK Kakkar Suvankar Halder Pramod Kumar	Indian Institute of Remote Sensing, Dehra Dun

this project which in no way doubting their specific capacity to GDP and employment computation. Since this exercise involves the vast accumulation of empirical knowledge and analysis in the study city, a two-semester work of all students and faculty in collaborating universities is envisaged as part of their ongoing academic programme. Participating universities decided to have one year of the Smart metropolitan regional programme focussing on this topic in selected cities in several of their ongoing academic subjects and programmes. We found that exploring boundary of knowledge is within the terms of reference of any university. This can be conducted as design studio programmes or small projects as parts of theory classes. It can also be independent post-doctoral work. Within each partner university, the collaborating faculty may design this research programme, and thereafter faculty compiles the research findings for publication based on students and faculty work. In most of the partnering universities, there are studio programmes with 9–15 h per week programmes where a project is executed by a group of students under close supervision and guidance of faculty with higher faculty–student ratio, and there are theory papers where a student must work independently

on a topic under the guidance of generally one r two faculty. This work can be a mini-project, which she/he completes within one semester or a term paper. The department integrates the research programme with their academic programme by deliberately having studio programmes and term papers centred on this area of study.

18.9.2 Role of Students

This international collaborative research programme is essentially meant for students being part of an internal academic programme of the university. We consider they are the main actor and shall be given important role in this programme. Perhaps many that age group will live in the Smart Cities than their older faculty. Under the direction of faculty new concepts were introduced in the studio and empirical studies were conducted around these concepts.

18.9.3 Role of Faculty

The faculty is the designer of the program within the framework of existing curricula in design studios and theory courses of each participating university.

I. The project duration is one academic year or two semesters.
II. They guide and monitor student work as usual as part of the academic programme.
III. They monitor students' input to the monthly progress report.
IV. They rewrite the output of the project for a book to be published by an international publisher.

18.9.4 Co-design and Co-production of Knowledge

This international collaborative research programme is founded on the principles of co-design and co-production of knowledge. In today's interconnected world, such collaboration is physically and intellectually possible—thanks to the Internet and ICTs. The collaborative aspect of the research programme will be actualized in the form of:

I. Co-design the programme with the partner academic institutions.
II. Co-production of knowledge through an interactive process of sharing, reviewing and finalizing research findings.

III. Within each partnering institution, co-design and co-production of knowledge can be implemented through design studio/laboratory work between faculty and students.

18.9.5 Research Output

The key output of the "Smart metropolitan Regional Development" research programme will be a book edited by the coordinator Professor T. M. Vinod Kumar, to be published by Springer-Nature, an internationally reputed publisher in 2018.

18.10 Bulletin

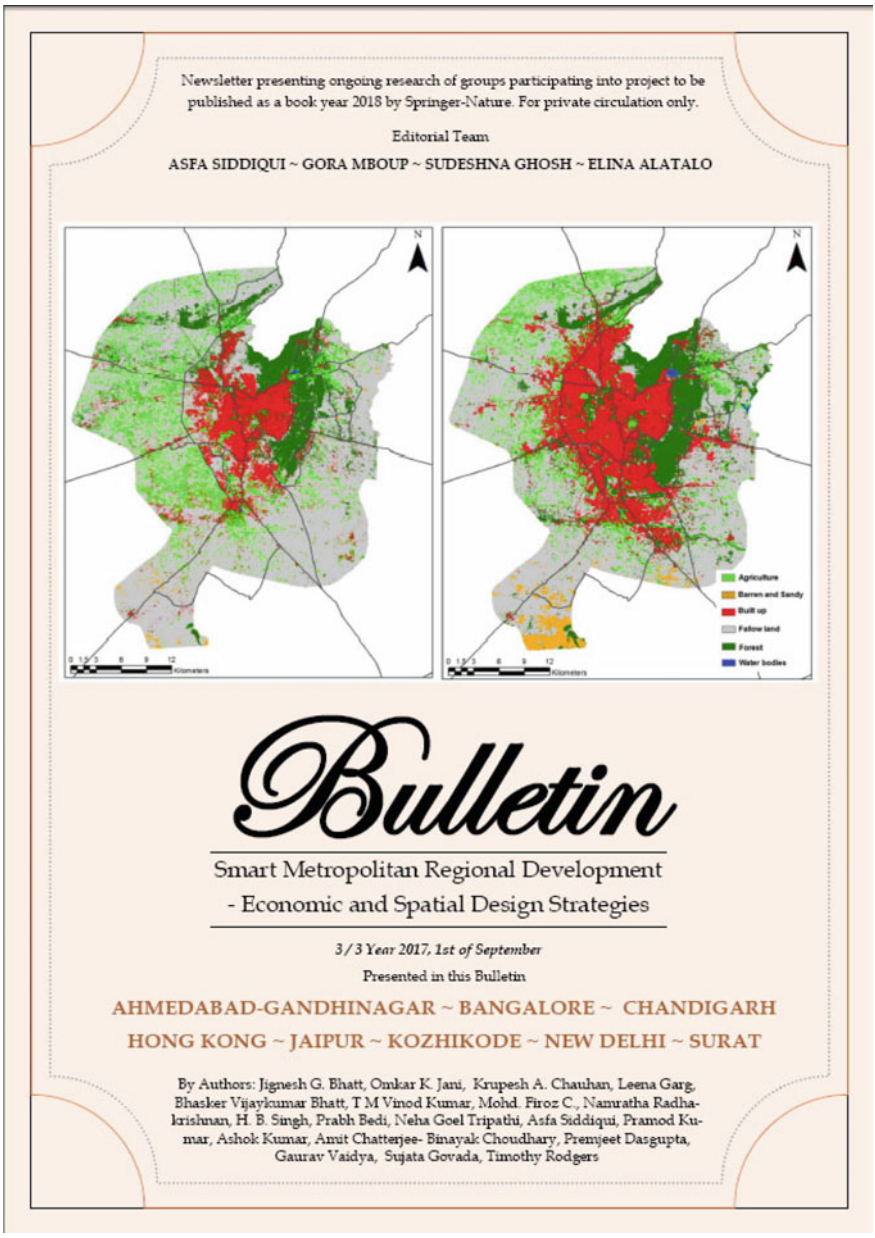
During the conduct of research about 12 months through in 2017, three Bulletin has been used to communicate with the international teams of researchers. These Bulletin highlights study metropolitan city profiles selected by the various study teams independently, and introduces to the research network the research methodologies adopted, and the profiles of authors of the research output for the book, "Smart Metropolitan Regional Development: Economic and Spatial Design Strategies". The Bulletin is jointly edited by a Bulletin team, Elina Alatalo, Sudeshna Ghosh, Gora Mboup and Asfa Siddiqui.

The list of Bulletin produced with respective case studies is shown in Table 18.2.

Table 18.2 List of bulletins

No.	Country	City	Bulletin number/date
1	Germany	Stuttgart	1/15 March 2017
2	Italy	Naples	1/15 March 2017
3	The USA	Pittsburgh	1/15 March 2017
4	Dakar	Senegal	2/1 June 2017
5	Guinea	Conakry	2/1 June 2017
6	Nigeria	Abuja	2/1 June 2017
7	South Africa	Johannesburg	2/1 June 2017
8	Kenya	Nairobi	2/1 June 2017
9	India	Ahmedabad-Gandhinagar	3/1 September 2017
10	India	Bangalore	3/1 September 2017
11	India	Chandigarh	3/1 September 2017
12	India	Jaipur	3/1 September 2017
13	China	Hongkong	3/1 September 2017
14	India	Kozhikode	3/1 September 2017
15	India	New Delhi	3/1 September 2017
16	India	Surat	3/1 September 2017

A cover page of the Bulletin 3 and one sample page of the Bulletin is given below.



Newsletter presenting ongoing research of groups participating into project to be published as a book year 2018 by Springer-Nature. For private circulation only.

Editorial Team

ASFA SIDDIQUI ~ GORA MBOUP ~ SUDESHNA GHOSH ~ ELINA ALATALO

Agriculture
Barren and Sandy
Built up
Fallow land
Forest
Water bodies

Bulletin

Smart Metropolitan Regional Development
- Economic and Spatial Design Strategies

3/3 Year 2017, 1st of September

Presented in this Bulletin

AHMEDABAD-GANDHINAGAR ~ BANGALORE ~ CHANDIGARH
HONG KONG ~ JAIPUR ~ KOZHIKODE ~ NEW DELHI ~ SURAT

By Authors: Jignesh G. Bhatt, Omkar K. Jani, Krupesh A. Chauhan, Leena Garg, Bhasker Vijaykumar Bhatt, T M Vinod Kumar, Mohd. Firoz C., Namratha Radhakrishnan, H. B. Singh, Prabh Bedi, Neha Goel Tripathi, Asfa Siddiqui, Pramod Kumar, Ashok Kumar, Amit Chatterjee- Binayak Choudhary, Premjeet Dasgupta, Gaurav Vaidya, Sujata Govada, Timothy Rodgers

A page of Bulletin is as shown

PITTSBURGH

PENNSYLVANIA, UNITED STATES

Sudeshna Ghosh – Sweta Byahut – Calvin Masilela

Introduction

The mid to late 20th century rust-belt cities in the United States (US) witnessed a trend of decline in its manufacturing base, compelling them to rethink urban and economic development strategies to compete in the 21st century. Pittsburgh, one such example of a rust-belt city, was once known as the "Steel City" due to its production capacity of raw steel in the world economy. With comparative advantage of natural resources and navigable waterways, the city burgeoned with large-scale steel mills since the 1870s and an economic and population base to support these activities (Detrick, 1999). The geographic shift of manufacturing activities towards lesser developed countries since the late 20th century triggered a process of decline in the old manufacturing cities of the developed world. Pittsburgh lost its position as the Steel City, and witnessed a continuous trend of decline in its manufacturing-based economy and population in the past three decades.

The challenge of economic decline coupled with massive brownfield sites, population loss, property abandonment, poverty and high crime, instigated planners and policy makers to adopt new strategies that could transform Pittsburgh and make it competitive in the "New Economy." Since the 1980s, Pittsburgh was successful in adopting many bold policies and strategies that transformed its local economic base towards advanced service sectors: healthcare, higher education, technology, research and development, banking and finance.

Dating back to the 1980s, Pittsburgh has been adopting various right-sizing strategies to stabilize declining neighborhoods. As a result, the city is able to provide a relatively high quality-of-life to its residents within affordable prices, despite abandonment, blighted areas, crime and poverty (Hollander et. al., 2009). These strategies mostly focused on economic diversification, regeneration of brownfields, urban greening and green infrastructure practices, which form the underlying principles of sustainability in Smart City concepts .

With high concentration of employers in the areas of medical research, such as University of Pittsburgh Medical Center (UPMC); higher education, such as Carnegie Mellon University and University of Pittsburgh; banking and financial sectors, such as Pittsburgh National Bank (PNC); and other Fortune 500 companies; Pittsburgh is becoming more successful in transforming its economy. Recently, Uber chose Pittsburgh as its research center for experimentation with driver-less smart cab services.

Pittsburgh Skyline, 2013: Confluence of Allegheny and Monongahela rivers. (source: Dr. Kevin J Patrick)

3

18.11 Summary of Conclusions and City Case Studies

Team leaders of authors were requested to prepare a summary of conclusions of their city studies and the Editor compiled it and is given below.

18.11.1 Smart Metropolitan Regional Development: Economic and Spatial Design Strategies

An overview view of smart metropolitan regional development is presented as a backdrop for research studies of this book in the first chapter. First, metropolitan region is defined followed by its form and functions. Then, smart metropolitan regional development is defined. The chapter studies the global metropolitan cities development and shows how metro cities, megacities and meta-cities are emerging across the world by regions. This process had accelerated in the last decade. Metropolitan cities are continuously exposed to external economic changes and require intermediate range strategies to face it which is not there in a 20-year Master Plan. These periodic economic strategies of cities call for differing spatial strategies to intervene in emerging global situation. To reshape these emerging metropolitan challenges, there is a need to design economic and spatial strategies. Therefore, this chapter concludes with a critical analysis of 17 metropolises in their official plans with their economic and spatial design strategies attempted there.

This chapter introduces the international collaborative research studies of 16 smart metropolitan regional development of the book drawn from 10 countries from USA, Europe, Africa and Asia. The emerging scenario of metropolises, mega cities and meta-cities temporally and spatially across the world based on UNHABITAT statistics and projection is discussed. GDP creation of nations is taking place very actively mostly in these three types of cities across the world which are projected for 2025. Spatially and economically, higher population and GDP growth rate in these cities is now evident and happening mostly in the eastern and southern hemisphere than in the western and Northern. This book concentrates on more number of studies from the east and south than the west and north. City society through their legal framework of constitution brings about the creativity of design of an economic and spatial strategy to take these cities to the next level facing all local challenges through their official Master Plans. The design of economic and spatial strategies is presented for 17 cities based on official plans. Not all these cities give equal importance to economic strategies in contrast to spatial strategies. Often there are plans with less attention to strategies in general and economic strategies. Some of them do not mention economic strategies at all. Metropolitan Planning and implementation should move from geographical space to community and then to prosumer households both for planning and implementation, but this is happening only in a few cities presented in this chapter in a very limited way. These plans shall be considered as a design for societal change and should not be just for bringing out

the infrastructure provision required for the bureaucracy to implement. What is happening is also not satisfactory. There is no possibility for a generalised design of spatial and economic strategies for metropolises since each city is unique and mobilising communities for the design is the only way through E-Democracy with intensive use of ICT and IOT by society and continuing training for smart community based metropolitan development by every household.

1. This first chapter explores large cities of one million and above with special references to the design of economic and spatial strategies of the smart metropolitan region. With such concentration of people in the limited area these cities have an important role in economic development of the nation. Further bigger the size of the city in population and area the spatial issues are more complex and challenging. Although Master Plan is expected to sort out these issues, the author would like to explore how far it is achieved in a study of 17 metropolises around the world.
2. Metropolitan cities are continuously exposed to external economic changes and require medium term strategies say 5 years to face it. These economic strategies of cities call for differing spatial strategies to intervene in emerging global situation.
3. There has been an attempt to convert many metropolitan cities, largely using selective investment strategies and procedural administrative rules arbitrarily not sanctioned in the constitution in a limited part of cities with no economic and spatial rationale to smart cities world over. In many smart metropolitan city projects, only a part of the city has been taken up for the smart metropolitan city program and in many cases, it is status and elitist area of cities like New Delhi Municipals Committee area in Delhi and not where low-income people live under 100 smart cities project of India. What is required is to take the whole metropolis to convert it to smart metropolis using smart economic and spatial strategies in many steps and in many years. Designing economic and spatial strategies for Smart Metropolitan Regional Development shall be conducted by the spatially identifiable economic community at micro levels from time to time to suit the ever-changing scenarios of the economic environment.
4. If a city also performs an important commercial, cultural and political function for its region or even the whole country can be called a metropolis. Such a major importance can usually be assumed for cities boasting some 500,000 inhabitants in Europe and one million plus in India. On the other hand, Global cities are those selected few metropolises whose political, cultural and commercial influence extends across the entire globe (e.g. New York City, Tokyo or London).
5. As social spaces, metropolitan areas or regions can be characterised by the following four dimensions: Metropolitan regions are defined as an accumulation of specialised metropolitan facilities including public and private services. In terms of actors and actions, metropolitan regions constitute an arena for key regional stakeholders to exchange knowledge on joint regional

objectives, strategies and projects, as well as on the necessary organisational structures. In the context of spatial development, metropolitan regions are a normative and guiding concept intended to contribute to innovation, creativity and economic growth. About the symbolic dimension of urban and regional development, metropolitan regions are the medium of symbols, norms and values which convey aspects associated with the specific brand image of metropolis and urbanity.

6. Authors of the book "Geographic Information System for Smart Cities" Edited by T. M. Vinod Kumar examined several definitions of smart cities and were not satisfied and came out with their own definition. "The smart metropolitan (area/region) city is a knowledge-based city that develops extraordinary capabilities to be self-aware, functions 24 h and 7 days a week, communicate, selectively, knowledge in real time to citizen end users for a satisfactory way of life, with easy public delivery of services, comfortable mobility, conservation of energy, environment and other natural resources, and creates energetic face to face communities and a vibrant urban economy even at time of national economic downturns". All six components of smart cities such as Smart Economy, Smart People, Smart Governance, Smart Mobility, Smart Environment and Smart Living is implied in this definition has been presented in detail in the four books of this series by the author.
7. The concept global economy with partnership and division of labour of global network of cities is not new, but those who talk about a globalised economy insist that there have been distinct changes in its structure and modes of production. Whereas earlier economic activities crossed national boundaries, globalisation includes a deeper integration, where transnational corporations orchestrate production from various locations. Global places indicate a rising of networked society globally which can work effectively in a smart metropolis with high endowments of ICT and IOT.
8. The Global Urbanisation has five basic elements namely, new innovative technology, the centrality of information made possible by instant communication, an increasing trend toward the standardisation of economic and social products, growing cross-national integration, and mutual vulnerability stemming from greater interdependence.
9. UNHABITAT defined the metro cities as 1 million plus agglomeration 'mega-city' as with 10 million plus population and 'Meta city' which describes 'massive conurbations of more than 20 million people or above. Since ICT drives the mega city and meta city formation, these cities are smart cities in making.
10. In 2016, there were 512 cities with at least 1 million inhabitants (metropolitan region/cities) globally. By 2030, a projected 662 cities will have at least 1 million residents. As hubs of trade, culture, information and industry, they will be vested with such power that at many levels they will act as city states that are independent of national and regional mediation. Today mega cities are home to less than 10% of the global urban population.

In 2016, there were 31 megacities globally and their number is projected to rise to 41 by 2030.

11. There were eight meta cities above 20 million in 2016 in the universe, which is likely to be twice about 15–16 in number or little less in 2030 which may be considered as the accelerated graduation of mega cities to meta cities. However, the number of mega cities increase during this period which includes meta cities were from 31 to 41 which is not as impressive as that of the meta-cities.
12. Meta cities and Megacities are a key to globalisation, a state of interconnectedness around the globe that transcends and largely ignores national boundaries. Global urban economies rely on advanced producer services such as finance, banking, insurance, law, management consultancy, advertising and other services. The technology revolution has made it possible for business enterprises to hire these services anywhere in the world.
13. If mega cities including meta cities represent the economic hub of the future it is shifting towards Asia from America and Europe. Integrated spatial and economic strategies can help this transition. As per the current trend GDP growth rate in Asia is much higher than Europe and Americas and it is likely to continue for few decades. It looks like an Asian and African era is emerging. Growth rates of many mega cities in Asia and some in Africa are growing at higher rate than elsewhere
14. When compared to China, India and the US; the largest urban population is in China followed by India and US. The total urban population in India is higher than the US. The percent of the urban population in mega cities in India are more than US and China in that order. China has all its metro and mega cities in the East facing the sea leaving a vast stretch in the western area without mega, meta and metro cities. China is fast moving towards a one billion urban population. Among the urban population, the largest percent people in India live in megacities which are more than 10 million population. In Kerala state, India 76% of the urban population lives in million plus cities, followed by Maharashtra state (59%), and Gujarat (55%). The lowest percentage of people in India living in one million cities and above are Haryana (16%) and Bihar (17%). The largest number of million plus cities are in Kerala (7), and Uttar Pradesh (7) followed by Maharashtra (6) and Gujarat (4). The lowest number of one million plus cities are in Haryana and Bihar with one each.
15. There are already networks and corridors cutting across the boundary of nations which has given rise to the formation of urban settlements in 2016 in a globalised world.
16. Often the share of GDP produced in this mega and meta-city are considerable in comparison to total National GDP.
17. The projected GDP 2025 of top 30 Urban Agglomeration was used with projected population computed by UNHABITAT to derive average real GDP/population growth rate projected during 2008–2025. This shows that

GDP/population growth rates of largest 30 urban economies in the universe are generally low but there are few exceptions in the south and eastern urban agglomeration.

18. Tabulating under descending order of high GDP growth rate of first 30 urban agglomerations by GDP growth rate 2008–25 and then cities are organised by countries and found that these urban agglomerations are all in Asia and Africa. It can be seen the higher GDP performance cities are in large number in India followed by China and other countries. This justifies a maximum number of case studies in this book from Asia and Africa.
19. There is a division of labour across city regions transcending country boundaries sharing the economic responsibilities as per capabilities. Global urban economies rely on advanced and standardised producer services such as finance, banking, insurance, logistics, law, management consultancy, advertising and other services. The technology revolution and uniformity of standard practices have made it possible for business enterprises to hire these services anywhere in the world. The national hierarchy of cities and the spatial division of labour within the economy is superimposed by a global division of labour. Cities and metropolitan regions become part of an emerging international hierarchy based on a competitive division of labour at the global level by international connections that affect financial flows and the knowledge-intensive service sector.
20. Large cities are interconnected and influence global and reinforce spatial interdependent functional structure with appropriate linkages. The connection is twofold within its city region and outside the city region transcending other national boundaries. The city is connected to hinterland and outside world simultaneously in a metropolitan region.
21. World cities are characterised by a sum of political power (both national and international) and organisations related to government; national and international trade, whereby cities function as gateway for their own and sometimes also neighbouring countries; providing superior banking, insurance and related financial services; advanced professional activities of all kinds; information gathering and diffusion. The form and extent of a city's integration with the world economy and the functions assigned to the city in the new spatial division of labour will be decisive for any structural changes occurring within it.
22. The world cities exhibit the following;

    i. The nature of a city's integration with the world economy is decisive for any structural changes occurring within it.
    ii. Key cities throughout the world are used by global capital as 'basing points' for the organisation of production and markets.
    iii. The global control functions of world cities are manifest in the structure of their industrial structure and job markets.
    iv. World cities are major sites for the concentration and accumulation of capital.

v. World cities are destinations for large numbers of migrants—both domestic and international.
vi. World city formation exposes the major contradictions of industrial capitalism, particularly spatial class polarisation.

23. There are two trends of thoughts about Meta cities, Megacities, and metro cities. One tries to attain a position of the global city by deliberately executing spatial and economic strategies to achieve that goal following what is discussed in the earlier paragraphs. This is in addition to solving many city specific issues of metropolitan development. The second approach is how to make a metropolitan area a smart metropolis by appropriate spatial and economic strategies. Smart is ICT implementation in all activities including economic activities. Economic strategies may involve converting the region with all its economic activities to the smart economy as discussed in the book in this book series "Smart Economy in Smart Cities".
24. Since this book focuses on the area of design of economic and spatial strategies to achieve the overall goals of smart metropolitan development. A survey, of such designs of several official plans is undertaken here. Cities are selected randomly with no sampling plans. The following discusses only the appraisal of these economic and spatial strategies in several metropolises.

i. **Delhi NCR Metropolitan Region**. Although Delhi will be the second largest meta city in the world in 2030 after Tokyo and therefore is a global city. There is no such consideration in the NCR Plan. Also, there is no deliberate promotion of the city to a smart metropolitan city with appropriate ICT-IOT design and related spatial strategies. The economic strategy adopted by the NCR planning board is not efficient enough for a city such as Delhi. The stated Delhi strategy of making trade and commerce barrier free which is the aim of Goods and Service Act 2017 nationwide within NCR will not suffice for Delhi. Other specific issues mainly administrative issues are not addressed for further easing to do business and giving impetus for the development of industries. Interstate agreement on unified policies can create chaos and may reach a long time to reach consensus. This might be a hindrance to further development of NCR region. Increased ease of doing business, transparent laws and regulations for the same have not been given due consideration. Also, focus on people and skill development for economic development is not visible. Smart mobility based spatial strategy is not stated.
ii. **Vancouver Metropolitan Region**. In the case of Vancouver, there is a strong economic strategy in place. Local businesses and talents are nurtured which results in a booming diverse economy. Brain—drain is prevented by attracting foreign Canadians and immigrants with attractive and affordable housing and environment for families. This is a strategy to attract a skilled workforce. Integration of universities with business centres for productive R&D yet another important step in

economic growth. They have thoroughly invested in the clustered growth of industries with an increased focus on green jobs to remain sustainable in the long run.

iii. **Melbourne 2030**. Planning for Sustainable Growth. Plan Melbourne does not identify how the government will respond to the impacts of climate change. The Metropolitan Planning Authority must work in close partnership with Local Government, in the future planning for Urban Renewal Areas. Initiatives to 'streamline' the planning system which limits community involvement in the planning process, or reduces Local Government's decision-making responsibilities, are not supported.

iv. **Shanghai Metropolitan Plan**. Shanghai is now facing great opportunities in turning itself into an international economic, financial, and trade centre. China's continuous economic growth provides a solid base for Shanghai to move toward this goal. Shanghai has set its long-term strategic objectives for social and economic development. By 2010, Shanghai is planned to become one of the international economic, financial and trade centres of the world. Shanghai aims to form the economic scale and comprehensive strength of a world metropolis; optimise urban spatial distribution, modernise the city's physical infrastructure, participate in international labour division and the circular flow of the international economy, introduce the operational mechanism of a socialist market economy, and pursue the balanced social, economic and environmental development. Economic Strategies plan is to optimise and upgrade the industrial structure, trying to improve the pivotal status of Shanghai in global city network and process to accelerate the technological innovation.

v. **Mumbai Metropolitan Regional Development**. The Economic strategy given by the metropolitan plan is very broad. Mumbai Metropolitan Regional Plan 2016–36 mainly addressed issues of growing urbanisation, uneven distribution of jobs increasing commutes, lack of affordable housing and basic infrastructure in the region, environmental degradation and inadequate governance. The existing situation of Mumbai Metropolitan Region is analysed sectoral and cross-sectoral to arrive at issues that need to be addressed in the Regional Plan 2016–36.

vi. **New York**. The economic strategy adopted clearly touches every aspect of the economy. The plan also emphasised on strengthening the fundamentals such as workforce which is very important in achieving economic development. The New York Metropolitan Region has a separate spatial plan, transportation plan and economic development plan. The strategies adopted clearly ensure sustainable and long-term growth in jobs and income to contribute to the resurgence of the broader economy of New York State. Also, they have a detailed transportation development plan which has a shared vision for sustainability.

vii. **Calgary Metropolitan Region**. The Calgary Regional Partnership (CRP) and member municipalities will work together to ensure a diversified and globally competitive region that continues to enjoy a high quality of life and is able to attract and retain a viable and adequate regional workforce and member municipalities will endeavour to achieve a distribution of jobs creation and economic activities throughout the region consistent with transit and complete mobility policies that encourage the location of jobs close to where people live. Recognising the connections and relationships that exist between communities, the Calgary Metropolitan Plan (CMP) acknowledges and respects the vital and historic importance of rural lands, industry and culture in the region. What are the industries and where those can be established to boost the economy and employment is not stated? What are the land management techniques suitable in this region are not mentioned? There is a lot of potentials to develop tourism which is not at all described. They mentioned that various studies need to be done to analyse the economic boost but what are those not stated. The Calgary Metropolitan Plan is the blueprint for accommodating growth in future. The plan giving the various strategies to make Calgary as a healthy environment in enriched communities, with sustainable infrastructure and a prosperous economy.

viii. **Kuala Lumpur Metropolitan Regional Development Plan**. The vision and goals for Kuala Lumpur have been formulated with the aim of creating a sustainable city. City Hall Kuala Lumpur (CHKL) shall ensure that the planning of the City shall strike a balance between physical, economic, social and environmental development. Local Agenda 21 shall be adopted to encourage citizen participation towards creating a sustainable society. This is in line with government policies of implementing sustainable development strategies as stipulated in the Habitat Agenda of the Rio Declaration.

ix. **London Metropolis**. The London Plan sets out a new approach for planning in London. It emphasises growing inward and upward so that it can reduce the costs of growth, create walkable communities, revitalise our urban neighbourhoods and business areas, protect our farmlands, and reduce greenhouse gases and energy consumption. The plan sets out to conserve our cultural heritage and protect our environmental areas, hazard lands, and natural resources. Through the London Plan, the community is planning for vibrant, healthy, safe and fulfilling neighbourhoods, attractive and viable mobility alternatives and affordable housing that is accessible to those who need it. At the root of The London Plan is the goal of building a city that will be attractive as a place to live and invest in a highly competitive world and one that will offer the opportunity of prosperity to everyone—one their own terms and in their own way.

x. **Berlin Plan 2035**. The Berlin Strategy provides an inter-agency model for the long-term, sustainable development of the capital. With one-third of the city comprising of open spaces, a compact polycentric development, highly tolerant society, the development plan further proposes to enhance these key selling points of Berlin. The development plan builds its foundation on the strong points of Berlin and proposes strategies to tackle the challenges. Provisions of affordable housing, further increasing the short distances to amenities, enabling a start-up friendly environment are some of the key proposals of the plan. Cultural diversity and tolerance in the society are used as a selling point for the attraction of workforce and tourists. Community participation is given utmost importance. The economy focuses on the educational institutions, research centres, attracts skilled labour from all over the world. Using a range of strategies and goals, it sets out the areas and directions in which this growing city should develop and highlights the areas that will form the focus of its future development.

xi. **Dhaka Structure Plan 2016–2035**. The Dhaka structure plan covers the basic issues such as effective land use management, transport for efficient connectivity, enhancing employment and productivity, public Facilities, and protecting the natural and healthy environment. The spatial concept of dividing the planning area into two broad categories i.e. Urban Promotion Area (UPA) and Urban Control Area (UCA) is an efficient way to assure uniform distribution of development. Here, the basic requirements are made available at each functional region reducing the dependency on the core city. At the same time under the UCA flood flow zones, Water Retention Area, National and Regional parks, Forest Area, and large-scale Heritage sites are preserved. Instead of focussing on individual plot based development, the concept of planned unit development is introduced. The plan talks about increasing the productivity of the informal sector, which is a good step towards mitigating urban poverty. The garment sector, leather manufacturing which boosts women employment is also planned to make it more efficient. While the report covers all the broad aspects required for the development of a region, the involvement of the public in the planning process would provide a more achievable and efficient plan.

xii. **Master Plan for Patna Metropolitan Region**. The Metropolitan plan for Patna, though it takes into consideration, the Economic aspect of the city, doesn't provide a sufficient Economic Strategy for development. The plan has a concept for the spatial development of the city. The spatial strategy is fairly achieved. The Implementation plan simply explains a case study for TP schemes from Ahmedabad. There is no strategy adopted. Also, it doesn't consider each project in detail. The Economic approach in the Master Plan is only by addressing the land requirement for various employments generated. There is no mention about Economic Strategy. Patna being the only important city

in the state has acquired the strong position in regional trade and business. It is necessary to have an economic strategy while planning for Patna. The Master plan lacks this. Instead, an overall development which also leads to economic development is attempted. Implementation plan doesn't consider every project in detail.

xiii. **Montreal Metropolitan Development Plan 2020**. Economic strengths are utilised and creative market and the smart economy are aimed to achieve through these strategies. A clear and comprehensive economic strategy is provided in the Master plan. The implementation strategy to carry out each strategy is also explained. The idea of Smart Metropolis is carefully dealt here which is considered as the most innovative and sustainable development concept in the current scenario. Montreal is a large city with a diversified economy needed a spatial and economic strategy which is formulated and explained well in the Master plan. Issues and potentials were identified and addressed carefully.

xiv. **Helsinki**. The spatial structure for the economic/business development is mentioned. But the kind of economic activities is not clear even though the zones are marked. The spatial zoning of economic activities is done such a way that it is around the city centre and large-scale industries are placed away from the centre which has easy access from nearby places. Retail activities are evenly distributed in all area.

xv. **Istanbul 2014–2023**. The economic strategy discusses all the sectors to make a globally decisive, high value added, innovative and creative economy. The focus has been given to entrepreneurship to encourage the work participation thereby eliminating unemployment that would lead to a better vibrant economy. The main idea of entrepreneurship is to be appreciated as the city will sustain its own economy rather than depending on external revenue as in trade. Even though the strategies and objectives are discussed elaborately the implementation is not detailed which makes it difficult for the region to put these concepts into reality. The Metropolitan Plan discusses a vision for Istanbul, spatial and economic strategy. The very important part was the public participatory approach so that the people of the place make the place. All the strategical domains are made with the opinions of the citizens and thereby solve their issues and each project is for the development of the city and the citizens. The economic domains include the transformation of the industry, ascending R&D, encouraging entrepreneurship, and increasing employment. All these directly or indirectly stand for the citizens. The spatial domains are increasing spatial quality, holistic urban transformation, protecting the culture and history, effective disaster management, sustainable transport.

xvi. **Limerick**. The Limerick city is a place where the economic activity is degrading due to various factors like recession, improper management of assets like tourist spots educational institutions etc. The people of the place are facing unemployment also. The investments from other

countries decreased due to the recession. The strategies are made to overcome all these difficulties and to make the Limerick as a thriving economy better than any other surrounding Irish economies. The economic strategy they prepared had three divisions based on their weak points as well as potential, but the spatial strategy is not a well prepared one. It does not take care of the start-ups and business people. It concentrated on the infrastructure like road and buildings with potential, also the quality of standard of living of people, the tourism and recreation will increase the economic activities but for long-term economic growth the facilities for the investors also to be taken care of.

xvii. **Tokyo**. The smart metropolitan city strategy in Tokyo, the "Smart Energy City", was launched in May 2012 and builds on the emergency measures of energy savings which were enforced following the Fukushima accident in March 2011. Tokyo has further developed as a smart metropolitan city through the promotion of renewable energy sources and smart meters in the central wards and the larger metropolitan area, along with several smart community initiatives. The Tokyo Metropolitan Government's (TMG) Bureau of Environment is very active in promoting energy efficiency and has achieved a 15% cut in CO_2 emissions in the industrial sector for instance. Despite such measures though, energy efficiency and carbon dioxide emission targets may be difficult to achieve by 2020. The TMG is cooperating with the Tokyo Organising Committee of the Olympic and Paralympic Games (Tokyo 2020 Committee) to build on the existing green policies of the TMG and elaborate a concrete strategy for sustainable Games preparation and operation. Several obstacles can slow down enterprises' market access in Japan. The complexity of Japanese regulations and the lack of transparency of business practices can be challenging in some sectors for new companies which are unfamiliar with the language and the business culture. While 2020 is a catalyst and deadline for projects that are approved by the central and local government, it does not slow down the development of other smart community projects elsewhere in Japan.

The above presented constitute the conclusions of Chap. 1. What follows is the presentation of conclusions from Chap. 2 onwards of this book.

18.11.2 Hong Kong Study

Background: The Greater Bay Area (GBA), originally known as the Pearl River Delta (PRD), comprises 9 cities in Guangdong Province of Mainland China (Dongguan, Foshan, Guangzhou, Huizhou, Jiangmen, Shenzhen, Zhaoqing,

Zhongshan, and Zhuhai), and the two cities of Hong Kong and Macao in their respective Special Administrative Regions (SAR). The GBA has and continues to rapidly develop into a significant and influential mega region in China, Southeast Asia and the world. With the new initiative from the Central Government towards the development of the Guangdong-Hong Kong-Macao Bay Area (GBA), along with the Belt and Road initiative and adoption by Hong Kong and other cities in the region, the GBA is set to take its development to the next level with smart regional metropolitan development. As such, the GBA provides a great opportunity for Hong Kong to reposition itself within the region, and hence has been considered more seriously in recent years and is referred to in the 2017 Policy Address.

Within less than 50 years, the economic reforms of China and the Open-Door Policy in 1978 transformed the primarily rural agricultural region into the highly populated, sprawling and urbanized high-tech value-added manufacturing region it is today. During this period, Hong Kong played a significant role in the growth and development of the GBA, with its more mature economy providing crucial support through its financial institutions, legal and professional services, and developed international trade and logistics hub, allowing businesses in the GBA to scale and reach global markets for their products. This in turn established economic, social, and political connections, collaboration and cooperation between Hong Kong and cities in the GBA such as Shenzhen, Guangzhou, Zhuhai and Macao among others, as well as improvements in infrastructure and transportation networks that have enhanced regional accessibility and integration. Going forward however, Hong Kong's role and competitive advantage in the region is being challenged as other cities in the GBA continue to grow larger than Hong Kong both demographically and economically. As such, Hong Kong is at a time where it must both reposition itself within the region and safeguard its global role, especially as Hong Kong becomes more and more integrated with the rest of the GBA in Mainland China.

Assessing Smart City Smart Region: Over the years, the Hong Kong and GBA governments have developed and implemented numerous initiatives, both hard and soft, which have brought the two places together through business collaborations, social interactions, as well as environmental cooperation and political agreements among other new initiatives. The design of the spatial and economic strategies of Hong Kong and the GBA has therefore reflected these developments and initiatives over time.

Predominately, Hong Kong has played a vital role in the growth and development of the GBA and its industries by undertaking the role of the logistic, transport and economic hub, and global connector of the region. As a result, partnerships and collaborations in the form of economic agreements to encourage investment and ease regulations, setting up of professional institutes and Science and Technology parks to facilitate R&D and innovation, and increased business development between Hong Kong and Mainland companies, have helped spur the economic growth of the region. Facilitating this growth is the provision of new major infrastructure projects and transportation links such as the HZMB and XRL, which have unfortunately suffered from delays and cost overruns, taking longer than anticipated to implement. This is in addition to extensive existing multi-modal

transport networks and routes, with a growing number of border crossing points that facilitate the flows of people, goods and services between Hong Kong and cities in the GBA. Moreover, it is great to see that there is a push towards more sustainable transportation throughout the GBA with the promotion of electric vehicles and dock less bicycle sharing systems.

Hong Kong and the GBA have also been cooperating on numerous utility and energy infrastructure projects within the region through partnerships and investments in new facilities that allow the joint production and sharing of energy, as well as regional environmental policy and target plans to transition to clean energy and reduce harmful emissions in both road and marine transportation. Moreover, collaboration on improving the living environment and ease of cross-border commuting for both Hong Kong and Mainland citizens has also been occurring. This has led to the proliferation of the number of cross-border commuters for work, leisure, education and healthcare services, as well as increasing investments and partnerships between higher academic institutions in Hong Kong and the GBA, as many universities have set up campuses or partner institutions in Guangdong province to capitalize on the talent and resources in the GBA. This has established significant spatial and social connections between Hong Kong and the GBA, which will only grow more prominent as closer integration occurs.

In planning for the future, recent spatial master plans and policy directives of Hong Kong and the GBA reflect a more collaborative and integrated regional approach to future and studies regarding the development of the GBA. This includes high-level national support from top levels of Chinese Government, in the "Outline of the 13th Five Year Plan for the National Economic and Social Development of the People's Republic of China" led by the National Development and Reform Commission, which addresses the development plan for a city cluster in the Guangdong-Hong Kong-Macau Bay Area, i.e., the GBA, and emphasizes Hong Kong's unique functional positioning and strengths. As well as the development of regional joint-jurisdiction initiatives, plans and studies among the GBA governments of Hong Kong, Macau and Guangdong to cooperate and collaborate on regional issues and decisions have materialized, such as the 2009 Planning Study on Coordinated Development of the Greater Pearl River Delta Township; 2012 Regional Cooperation Plan on Building a Quality Living Area; and Hong Kong's initiative as part of its 2017 Policy Address to set up the Guangdong-Hong Kong-Macao Bay Area Development Office to more effectively coordinate regional GBA issues by engaging and connecting with businesses and key stakeholders in the region, among others. In Hong Kong, particularly within the public sphere, there is a growing consideration and discussion regarding the need to plan for a future within its regional context. A recent workshop on "Smart City Smart Region" was held on 25th October 2017, in which discussions focused on how Hong Kong can transition towards a smarter city that is more integrated with the GBA. And on December 16th 2017 at a symposium titled "Future Cities, City Futures: Hong Kong and the World", the Hong Kong Government has recognised the importance of the GBA in future planning by explicitly talking about the Hong Kong 2030+ Territorial Development Strategy in the context of the GBA.

Towards Smarter Regional Development: In general, a clearer definition of the meaning 'smart' is needed, and as a society we need to go beyond thinking just about technology to develop smart cities, with more thought put towards focusing on people, place and planet that will result in a more liveable city that is smarter, sustainable and more resilient. Much of Hong Kong's opportunities will result by considering the city within the context of the GBA and will come from a smart and sustainable development approach that capitalizes on Hong Kong's inherent strengths and unique resources vis-a-vis other areas of the GBA that are complementary to the region, such as its strategic location, international positioning, established economy and industries, and educated talent pool. Hong Kong should also build on its advantage as a gateway city, in order to further its dominant role as a hub in the region and embrace opportunities beyond the GBA looking towards Southeast Asia and the Belt and Road Initiative. Given its strengths, Hong Kong must not become complacent, and should continue to strive to diversify its economy by embracing and supporting the creative, innovative, information and technology industries given its abundant resources in academia, talent, including its research and development capabilities.

At a social level, it is believed that attitude and mind-set change is needed, especially among the younger generations, to accept and embrace the regional opportunities that more cooperation and integration with the GBA will bring. It was recognized that more education, awareness and exposure for Hong Kong people, including the younger generations, with more frequent visits to the region and beyond, with more knowledge sharing among peers is the best way forward to achieve this. Improvements to living quality could come in the form of higher quality public spaces to encourage more diverse and engaging social interactions, and greater recreational interaction with the GBA cities. At the technology level, people in Hong Kong should be encouraged to be more forthcoming to share their data and information, and contribute 'smart' ideas with academia, the public and private sectors for more big data to be used to optimise and create solutions that directly benefit the specific needs and aspirations of the society.

Most importantly however, is the need for strong leadership and a strategic vision, guidance and direction of Hong Kong's Government and key decision-makers. At a political level, a bolder, and less risk-averse proactive Government with the ability to adopt more translucent and flexible processes is considered necessary to effectively and efficiently enact change to make Hong Kong more liveable, and transition to a truly smart, sustainable and resilient city that will effectively be able to collaborate and better integrate with the GBA region. Additionally, greater ability to turn public criticism into positive change through communication and understanding of what the younger generation needs and aspire for the future of Hong Kong is critical in uniting its society for enhanced local and regional integration.

Going forward, all future spatial, economic, social strategies and developments of the government, businesses and citizens of Hong Kong should be carefully considered and planned within the context of the GBA region, and not just locally. Since the 1970s, the design and collaboration of spatial and economic strategies

between Hong Kong and the GBA have been an integral component of the success and growth of the region's economy and urban development. The strategies have enabled Hong Kong to become one of the world's global cities and economies, as well as cities such as Shenzhen and Guangzhou to rapidly grow and develop their manufacturing and industrial economies to become the factory of the world. Now the GBA has grown and swelled into the mega-city region it is today, the next chapter for Hong Kong and the GBA will be one of closer regional integration and collaboration, and a push towards high-tech innovation and knowledge based advanced manufacturing. These spatial and economic strategies will need to be updated and improved upon to support and encourage the complementary growth of Hong Kong and cities in the GBA as one united mega-city region; through reductions in travel times, increased accessibility and cross-border commuting, improved urban liveability and quality affordable housing, enhanced academic and professional knowledge exchange, data and information sharing, and construction of collaborative smart developments along the border of Hong Kong and Shenzhen to promote greater integration and collaboration in society, technology and urban development.

Finally, it is best if Hong Kong as a city and Hong Kong citizens begin to understand and capitalize on the opportunities available, and embrace integration with the GBA as the way forward for Hong Kong to re-position itself and remain competitive in the new era of mega-city regions. This will require bolder, more risk-adverse decision-making authorities, greater community stakeholder engagement, and a need to look at Hong Kong as part of the GBA, which may mean establishing new spatial nodes within urban areas such as to potentially develop Victoria Harbour with the several development nodes and create new opportunities for leisure and recreations within the city and beyond. Hong Kong needs to be well prepared for future integration and growth of both new and existing industries, demand for housing, and the advancement of innovations in technology. As the global economy and spatial structure changes over time, Hong Kong needs to act swiftly yet smartly to move forward and retain the city's strategic global role and regional positioning.

18.11.3 Stuttgart Study

The Stuttgart region is a very prosperous area. The economical backbone of the region is the manufacturing of industrial goods. The globalization is a trigger for changing economical dependencies. Industrial processes are changing because of the new challenges. Digitalization is a current topic which has an influence on economical procedures. The main topic is the area "Industry 4.0". Next to the impact generated by the new thinking of manufacturing the digitalization open up new approaches.

The Stuttgart Metropolitan Region is situated in the centre of Baden-Wuerttemberg. This federal state is economically the most powerful area in

Europe. It creates 3% of the economic value in the European Union. The economic potential is mainly based on producing goods for industrial purposes, as machines, process technology and automotive parts. Based on the generated turnover, companies in these fields are contributing around 80% of the total economic value in the production sector. The companies in Baden-Wuerttemberg are mainly small to medium sized enterprises additional a high number is still family-run.

Coming to Stuttgart Metropolitan Region the focus lies in automotive products either cars or supply parts and products. In Stuttgart city and its surrounding which can be called Stuttgart Metropolitan Region over 2.7 million people live. The high density of people plus the widely spread industrial areas of different sizes generates a high number of commuters. The economic power with its potential for wealth and jobs let increase all living areas in Stuttgart Metropolitan Region. Additionally, Stuttgart was rated number one in the culture of all Metropolitan Regions in Germany. The Stuttgart Metropolitan Region is also seen as High-Technology location. The reason is the high amount of headquarters or big production and research location of multi-national companies with technical products. Well-known are Daimler, Bosch, Porsche, IBM, HPE and Hewlett Packard. Characteristically is the mixture of global companies and highly innovative medium-. sized companies. Innovation and research are well integrated into the Metropolitan Region. With a high number of universities and university of applied science and world-known research institutions (5 Fraunhofer-institutes, 2 Max-Planck-institutes and 6 institutes of DLR, plus others) the region has a high potential for innovative research and development in technology, products and services.

Location of industrial production and living have shorter distances. Additional it is common sense that sustainability is increasing in importance. Companies in Germany have already integrated the thinking on sustainability in their strategies because legal regulation forces them. However, the potential can be even extended when all entities in an industrial estate collaborate and use optimal technology. In this chapter it is presented how a framework for collaborative long-term development could be designed. It is presented how an implementation could be done on the different level of detail. This framework is currently on the way of implementation in the different industrial area in the Stuttgart Metropolitan Region and Baden-Wuertemberg. As stated the distance between living and industrial manufacturing zones is decreasing which requires new ways of processing.

Current discussions on sustainability are influencing the economic thinking. Obvious is the importance of sustainable development with respect to environment and climate. The climate conference in Paris was finished with a consensus of all present parties. All important economic nations created a common sense of climate targets. Reasons for that are limited resources and a huge amount of emissions.

Nevertheless, the society will only accept limitations, if not a reduction of living is a result. Based on that, it is necessary to implement a new way of doing existing structures. Additionally, it is required to implement changes without reduced economic potentials. The approach of symbiosis can support these developments. However, technology is a required extension to reach the target of sustainability.

In this chapter, different views are discussed to sustain long-term development. The first view is holistic. The idea of creating a symbiosis between enterprises in an industrial estate is easy to realize. A way is presented how industrial estates can be transformed towards sustainability. It is presented which methods can be used to support the transformation process under respect of strategical guidance. Based on the size and capacities of the industrial estate approaches of different detail and complexity. For the transformation companies change and also partners in the network. The approach shall help to identify suitable partners and matching cooperation. The long-term orientated creation of networks is supporting sustainable links with a high potential to reduce negative effects without reduced economic power.

Next to sustainable development of industrial estates the companies need a strategy for their development. A development path towards urban manufacturing is helping the management of companies to create a strategy. A concrete step-by-step approach is a base for an enterprise-internal transformation. Starting as conventional production enterprise a way for sustainable manufacturing is presented whereby different areas must change. The development path presented is supporting the strategic change process. With simple steps in different fields the companies are supposed to reach the target stage easier than without the development path. The target stage is depending on the size and power of the company independent of all conditions and can be defined freely.

The additional technological driver is analysed in its possibility of supporting the sustainability. Additive Technology is a new technology which supports a total change in production processes. Furthermore, the new technology supports sustainability by design because the potential currently is seen is a reduction of used material, reduce of waste, energy efficient processes, less effort in the adaption of processes even with a big variety of products. Nevertheless, the new technology requires a change in thinking and an adaption in processes. It is presented what areas in the value creation process are influenced by changes. An insight on use-cases is completing the analysis of the additive manufacturing technology.

18.11.4 Conakry Study

Considering its geographical location as a peninsula in the Atlantic Ocean, Conakry has the potential to be an agro-industrial, green city in addition to its huge potential of fish production. Wetlands areas are sources of income from agriculture, livestock, crafts, among other activities. They play an important role in maintaining the water quality and the prevention of natural hazards. These are also ideal places for reception and reproduction of waterfowl which are indispensable elements for the ecological balance of aquatic environments and key links in the food chain, hence the importance of the preservation of wetlands. If well planned and designed, Conakry can be a smart metropolitan region where citizens enjoy a high quality of life. In addition to its geographical advantages, the Conakry Peninsula has a

population of nearly of 2 million that, as large urban agglomerations, constitutes economic and social opportunities as well as challenges depending on how the urban growth is planned and managed. However, Conakry as most African cities has not been able so far to respond to growth in accessibility demand and several other needs such as access to water, sanitation, management of solid waste, and streets and other public spaces key elements of a city foundation.

Considering the proliferation of informal settlements along the rapid urbanization of the Conakry Peninsula and surroundings, the Government of the Republic of Guinea is developing a holistic approach, the "Grand Conakry Vision 2040", for smart metropolitan regional development through economic as well as spatial design strategies. The Grand Conakry Vision 2040 considers three spatial design strategies: (1) at the metropolitan level to develop and strengthen urban polarities; (2) at the agglomeration level to channel and structure urban extensions and; (3) at the peninsula level to develop urban renewal approaches. The main objective of the Grand Conakry Vision 2040 is, indeed, to "improve the living conditions of the residents of Conakry and adapt land-use planning and policies to the rapid urbanization of the metropolitan region". This is built on seven ambitious goals for a sustainable Conakry for all: (1) Strengthening territorial balances to create a network of solidarity-based cities in a preserved environment; (2) Controlling the city limits to prevent urban sprawl and preserve urbanization; (3) Optimizing the port system to decongest the city and protect the populations; (4) Restructuring the centrality to rebuild an efficient urban system on the peninsula; (5) Restoring the landscapes to build a healthier, safer and more enjoyable city; (6) Making the city sustainable to provide housing for everyone in mixed and lively neighbourhoods; and (7) Thinking waste as a resource to protect people, the environment and generate wealth.

An important aspect noted in the Grand Conakry Vision 2040 is that the spatial design of the metropolitan region is aligned with specialization: (1) Kindia has a strong potential for agricultural and agro-industrial development as well as for tourism development; Fria is an old mining industrial city (including aluminium); Tanéné, as a crossroads city, will ease the circulation of good in the metropolitan region and beyond; Boffa has a diversified economy (fishing, agriculture, solar salt, tourism, mining, etc.); Maférinya has developed agricultural production (particularly in pineapple); and Forécariah has various agricultural activities (banana, pineapple, mango, oil palm, etc.), particularly for export.

However, this specialization calls for efficient transport infrastructures that must be assessed, planned and implemented. Efficient mobility allows localities of urban agglomerations to specialize in the production of goods and services for which they have comparative advantages and ease inter-localities cooperation. This will also allow large-scale production of goods and services that can be distributed within the metropolitan region and beyond with time, cost and reliability opportunities. The spatial design of the Grand Conakry Vision 2040 is, indeed, aligned with the needs for transport with most of the urban centres of the metropolitan region connected to the main road of the city (PK36). In addition to that, transport strategies for the Grand Conakry Vision 2040 include: (a) Establishment of traffic restriction;

(b) Structuring a road network at the scale of the Greater Conakry metropolitan area; (c) Reinforcing the railway; (d) Organize maritime connections; (e) Develop a BRT system on its own site and improve the existing urban network; (f) Implement strategies for stationing; and (g) Gather typologies of structures and modes of maintenance of the road network. At long term (2020–2040), transport strategies will include: (a) deployment of a network of peninsular-scale secondary roadside stations (associated with the markets) and urban polarities; (b) the completion of the metropolitan road network and the organization of interurban public transport; (c) the continuation of the improvement of accessibility in neighbourhoods in relation to urban renewal actions; and (d) Structuring of the passenger rail mode.

18.11.5 Ahmedabad-Gandhi Nagar Study

With India transforming as matured democracy, the government is focusing on improving quality of life of citizens by urban renewal and infrastructure development vide ambitious smart cities project. Energy, the electrical power, has been the most crucial and the resource always in scarcity in India and proving itself as a major bottleneck. Therefore, India has been transforming legacy conventional non-smart non-intelligent unidirectional electrical power grids into modern smart grids which are bidirectional and intelligent in nature by leveraging ICT, IoTs, e-Governance and e-Democracy. Smart grids are likely to serve as energy backbones of smart cities and involve the high interactive participation of citizens in energy management, based on humanitarian and customer centric approach. Different types of Prosumers (Producers + consumers), their different energy requirements at different timings, different types of energy resources and their switching feasibilities considering different aspects have been integrated.

The Ahmedabad-Gandhinagar twin city metropolitan region is situated in between Ahmedabad and Gandhinagar cities and Naroda is a region of interest and study. This location is one of the most enterprising, industrial and commercial one in the state of Gujarat, India. The economic potential of the region is found mainly focused upon industrial, commercial as well as large scale residential citizens. The region is surrounded by reputed industrial, commercial, educational-research institutes and heritage monuments and demonstrates extremely encouraging potential for creative research, technological developments, as well as interesting possibilities of meaningful cultural exchanges.

The historic city of “Ahmedabad” or “Amdavad” or “Ahmadabad”, the largest city of Gujarat, has been recently declared as India’s first UNESCO World Heritage City in July, 2017. In 2010, Forbes magazine rated Ahmedabad as one of the fastest-growing city in India and the world. In 2011, Ahmedabad was rated India’s best megacity to live in by leading market research firm IMRB. Again in 2012, The Times of India chose Ahmedabad as India’s best city to live in. With a population of more than 6.3 million and an extended population of 7.8 million, Ahmedabad has been the fifth most populous, sixth largest and seventh most populous urban

agglomeration metropolitan area in India. Ahmedabad is located on the banks of the Sabarmati River, 30 km (19 mi) from the state capital Gandhinagar, which is twin city of Ahmedabad forming Ahmedabad-Gandhinagar twin city metropolitan region. Gandhinagar, the capital of the state of Gujarat in Western India, located approximately 23 km north of Ahmedabad, on the west central point of the Industrial corridor between Delhi and Mumbai. Built with parks, extensive plantation and recreational areas along the river, Gandhinagar has a green garden-city atmosphere. Naroda is a fast-growing area on the northeast side in Ahmedabad city, situated on the emerging Gandhinagar-Ahmedabad-Vadodara (GAV) corridor. With the establishment of the Naroda Industrial Area in the 1980s, it progressed well as separate town and later incorporated into Ahmedabad in 1996. Being eight km from Ahmedabad International Airport and located on the SP Ring Road, Naroda has over the last two years transformed from a neglected industrial area to desirable location for homes. The Naroda GIDC industrial park hosts national and multinational corporations. Several major township projects are being developed along the Ahmedabad-Vadodara expressway with Naroda being at the centre of the development.

This chapter presents an approach for metropolitan region development by effective energy management, active citizen participation and e-governance by making a proposal recommending deployments of smart grid and smart buildings with the integration of renewables, ICT and IoTs. In this work, ensuring 24 × 7 electricity supply along with limiting carbon footprint has been taken up as the major challenge and connectivity has been identified as a major bottleneck. Main objectives of this work have been to study existing economic and spatial strategies and recommend suggestions for the smart development of the metropolitan region. A five-step methodology has been suggested for the implementation of recommended approach:

(1) Integration of renewables

This has been covered by authors in "E-Governance for Smart Cities" Book [5] in this book series with a case of Gandhinagar Solar Photo Voltaic Rooftop Program in by including case-study of application of hybrid communication technologies deployed to serve need based data along with Development of Remote Energy Parameter Monitoring System. The proposed and implemented system has distinct features such as an affordable cost, scalability and anytime-anywhere monitoring, to encourage the inclusion of more sensors for enhanced data acquisition, improved spatial resolution for more fine-grained measurements and better monitoring of critical regions.

(2) Smart Energy (Deployment of Smart Grid)

Authors had also presented [6] democratic and citizen-centric approach of design-implementation of architectural details along with presenting a useful framework to make Smart Grid more inclusive, effective and comprehensive. Descriptions of communication technologies in form of instrumentation telemetry

deployed to timely serve need based bidirectional information between utility and end users have also been included.

(3) Smart People (Prosumers) and their participation

In E Democracy for Smart Cities book of this book series authors presented, smart grid as an energy backbone of Smart City is immensely vital and serving at the core of Smart City realization. Evolving e-Democracy, the smart grid includes the highly interactive participation of citizens in energy consumption domain, based on humanitarian and customer centric approach. Different types of customers, their different energy requirements at different timings, different types of energy resources and their switching feasibilities considering different aspects have been integrated. Critical smart grid subsystems (such as BAS, HAN, AMI, DR, etc.), ICT integration and GUIs have been identified as some of the major design considerations. 'Transformation of Conventional Consumer into Smart Prosumer' has been a major outcome of the work presented, since the customer has been now enabled as producer of electricity, thereby contributing to the grid and getting credits, which is adjustable against consumption.

(4) Smart Buildings with energy efficiency

Bhatt and Verma [7, 8], indicated the transformation of legacy stand-alone security systems into intelligent computerized-network based building automation systems, and presented design-development of IoT based working models for security and HAN-BAN. Development of a web-based virtual instrument to a run-time couple local/remote monitoring and control of the building has been the major outcome. The presented proof-of-concepts of IoT systems could be employed with suitable ICT for converting existing buildings into smart buildings with improved energy efficiency.

(5) Implementation with minimal financial implication

Massive national level awareness campaigns should be organized for citizens' awareness and encouragement for enthusiastic participation. Funding could be arranged from The World Bank, IMF, United Nations and developed countries to the government of India, which could be sent to state governments via Special Purpose Vehicles (SPV) such as RAPDRP. State governments should encourage the Prosumers via various state level programs in form of subsidies and other techno commercial support mechanisms. Under 'Make in India', indigenous manufacturers (SME and entrepreneurs in particular) should be encouraged for local manufacturing of devices, systems, software and engineering integration-maintenance supports. The entire mechanism should be operated as a single integrated system with single window clearance and e-governance.

18.11.6 Bangalore Metropolitan Region (BMR) Study

BMR with an area of 8005 km^2, and a population of 11.69 million is divided into 3 districts namely—Bangalore Urban, Bangalore Rural and Ramanagra. BMR has only one Corporation namely the Bruhat Bangalore Mahanagar Palika i.e. BBMP and 10 Urban Local Bodies (ULBs). Population influx in Bangalore is an obvious result of the continuous flow of migrants to Bangalore from surrounding areas and other regions. The current regime of the urban economy is that of agglomeration of an export oriented Information Technology sector which was initiated by developments in the early 1980s. Research Institutions such as ISRO, DRDO, IISc, IIM together with the Public-Sector Enterprises such as BEL, HAL etc. had established a base in the city for innovation oriented high technology production mainly in the areas of Electronics, Telecommunication and Defence. The largest IT firms in India such as Infosys, Wipro, Satyam and TCS were all small start-ups in the city and became large global conglomerates. Bangalore city is a key growth centre in the whole BMR with 81% of the working population residing in the city. The diversification of economic activity is quite extensive in Bangalore and a majority of the population is engaged in non-agricultural economic activities. The city development plan for Bangalore, 2006 reported that less than 1% of the workforce was engaged in agriculture.

The pattern of growth, with the city core becoming increasingly saturated, and new urbanization centres developing at the periphery, can be traced to multiple factors. In periphery areas of Bangalore, loss of agricultural land, water body, and green spaces are faster, and it is imperative that urban planning efforts concentrate of city periphery where unplanned growth is taking place at an extremely rapid rate. Primacy in BMR always hints the existence of regional disparity and Bangalore city always face problems of high immigration, high demand for urban infrastructure and deteriorating quality of life.

In the case of Bangalore there is a strong need to think beyond the city of Bangalore. Peeling away the layers of spatial governance jurisdiction we can see that it is the outermost layer, which is the BMR, which is of utmost importance. If the smart region vision must be given a spatial context, then it must be BMR. BMR is an amalgamation of the urban and rural, with the overwhelming presence of Bangalore City at its core. However, beyond it there are many smaller towns which are in no way less important. Some of these towns would in fact qualify as regional cities, given the tremendous rise in their population over the last decade or so. All these towns have their own local governments (Town Municipal Councils and City Municipal Councils). If a smart region is to evolve, the need of the hour is to promote cooperation between the entities and between them and BMC. The cooperation should be directly based on digital platform and smart networking should be explored.

In this context, the role of industry assumes great importance. The legacy businesses must transform into digitally oriented enterprises. Bangalore is already the technology capital of India, driven largely by IT. While the IT industry in India

is likely to emerge from the current downturn as much stronger riding on the back of technology transformation, it is the need of the hour to support them, and other industries, by providing facilities for digital innovation and incubation. The role of industry bodies will be of prime importance here, but again, the need is to connect them with the smart network of local self-governments, so that a synergy is achieved in terms of spatial decision-support and parameter-based prioritization without requiring complex interfacing among industry and multiple layers of government agencies. To achieve this, each of the regional cities around BMC must be developed as smart cities first. Recently Bangalore city has broken into the smart-city club. But it needs to be emphasized that merely promoting Bangalore City as a smart city will be a self-defeating exercise as the irreversible process and the tremendous rate of urbanization means that the region itself is transforming beyond limits of imagination and must be integrated into the context of a 'smart region'. After all, a smart Bangalore city which gets promoted in isolation will only distort the market further and lead to lopsided urbanization, costing society dear in terms of crowding, quality of public spaces, travel times, etc. If we look at the underlying concepts of smart city, we see themes like smart energy, smart health, smart living, smart mobility, and smart economy. Thus, the transformation of BMR into a smart region would mean more than location specific actions within the area. While smart energy interventions could be a thrust in the BMC area, piloting of such interventions could be easier in the smaller City Municipal Councils or Town Municipal Councils in the region. In fact, the population explosion happening in these regional centres outside BMC demands that they should also be considered for smart energy solutions. Smart health also needs to be scaled up to regional level through linkage between health institutions spread across the region, thus benefiting the rural settlements also. The first steps toward smart living at a regional scale would involve promotion of a dispersed settlement strategy dovetailed with transit oriented development and backed by incentives for affordable housing development and specialized economy oriented growth centres. Smart mobility would entail smart demand-responsive integrated regional connectivity catering to diverse commuter segments. Smart mobility strategies, with fast and high-capacity regional networks supported by efficient intermodal options, would complement smart living strategies as discussed. For spatial and economic development to convert BMR to smart, the definite tools like smart growth, transit-oriented development, mixed land use, industries dispersal and specialized zones etc. adopted. The ultimate spatial structure also recommended for the smart BMR.

18.11.7 Chandigarh Study

The "City Beautiful" Chandigarh was the outcome of modernist thinking foreseen by Pandit Jawaharlal Nehru in 1951. The dream remodelled into reality in the form of a planned city was the first of its kind designed by the celebrated architect planner Trio. With a total design capacity of 5 Lakhs (the population expected to be

met in 3 phases of development), sooner started falling short when compared to the demand within the insufficient space of 114 km^2. Also, the greenbelt estimated within the 16 km Periphery Control (earlier 8 km) were compromised to the dearth of urbanisation, principally leading to unplanned growth. The convenience of livelihood supported by unparalleled architecture and picturesque purlieu made Chandigarh the most idolised location for settlement. Being landlocked from all sides, Chandigarh found expansion in the new settlements Panchkula and Mohali and the three were together referred as the "Tri-City".

With slowing pace of growth rate in Chandigarh and the need of settlement in search of job prospects, Mohali and Panchkula were magnets of growth. This was the time when the conceived dream of "no construction in the Periphery" was overlooked against development demand. It is essential to mention that no legal document talked about a regional development agenda, driving coordinated planning in the Chandigarh region (16 km Periphery area). Efforts for regional planning like Chandigarh Urban Complex (CUC)-1977, Interstate Regional Plan for Chandigarh Region (ISCR)-2001 and Chandigarh Interstate Metropolitan Regional Plan (CISMeR) 2021 had no legal enablement. The lack of support from adjoining states made it have no hold and no powerful bearing on the region. In short, the Chandigarh Region had no plans that could rephrase and analyse its social, economic, spatial, environment or governance status.

For the purpose of this study, the 16 km Periphery marked initially in 1962 and bearing a legal sanctity was undertaken referred hereinafter as "Chandigarh Region" covering important growing settlements like Panchkula, Mohali, Kharar, Zirakpur, Banur, Dera Bassi, Mullanpur (New Chandigarh) and other smaller settlements. These settlements had their own vision of growth, where some had residential status (Panchkula, part of Mohali) and others had industrial status (all other major towns like Mohali, Zirakpur and Kharar). The demographic analysis of the region revealed that whereas the population growth in Chandigarh saw a declining decadal growth rate trend from nearly 114% in 1961–71 to 17.20% in 2001–11, settlements like Mohali, Panchkula, Zirakpur and Dera Bassi showed an increasing trend in growth. The various sub-regions within the regions were governed by different master plans of the settlements, primarily clubbed into three major documents—Chandigarh Master Plan-2031, GMADA 2008-38 and Panchkula Master Plan.

The spatial growth assessment for Chandigarh region suggests that nearly 400 km^2 of the area will be urbanised in 2048 (as per the MLP Neural Network based modelling growth scenarios using Land Cover databases of 2000, 2006 and 2012) as compared to 292.90 km^2. in 2012, 238.27 km^2 in 2006 and 224 km^2. in 2000. If we analyse the region's area outside the Chandigarh UT and within the 1 km Periphery, nearly 10.1% is the built-up area in 2000 (151.52 km^2), nearly 11.0% in 2006 (164.47 km^2) and 14.4% in 2002 (215.67 km^2). The growth trend in terms of spatial growth suggests an increase of 31.13% in the built-up area from 2006 to 2012.

The geospatial data and models have proven to be smart tools grossly leading the process of decision making for Master Plan preparation. The trio-technique of

Remote Sensing, Geographic Information System and Global Navigation Satellite System helped in various stages of plan making starting from database inventory preparation to plan to monitor for simulating future growth. With the help of modelling techniques, a future scenario of 2048 and 2024 was predicted, helping planners for an integrated sustainable planning.

Monitoring the demographic and spatial development scenario in Chandigarh Region, that the important drivers of growth for the region were proximity indices (proximity to the Chandigarh UT, roads, existing settlement, railways, CBD) and the gains and losses due to changes between 2000 and 2012. The highest impact factor (assessed using Cramer's V) was the change during 2000 and 2012 (0.4569), proximity to Chandigarh UT (0.4050) and proximity to CBD (0.3711). It was observed that out of the four layer outside the UT covering the Chandigarh Region, the layer just outside the UT showed the highest potential for growth. The growth scenarios also raised questions on the conservation of environment of the Region. The chapter correlated the concept of layers (layer 1–7) to that proposed in CISR-2001 (Planning Zones 1–4). It is felt that the Regional Plan should ponder on the issues relevant in the current growth scenarios like the preservation of agriculture land, protection and demarcation of forest land and its buffer for No Construction, conservation of water bodies in and around Chandigarh, propose afforestation and guided urbanization (proposed as per spatial growth projections for the future 2024 and 2048). It is further felt that top-down and bottom-up approach to planning should be followed at various levels like micro, meso and macro level for a holistic planning. It was felt that the idealistic planning for Chandigarh had lesser attention on planning for informal sector and planning for the poor (very much relevant in Indian social structure). Hence, the Regional plan shall focus on inclusive planning where space is designated for the different strata of the society without abandoning any one.

To transform the existing scenario into a Smart Regional Development scenario, it is essential to have a legal status to the plan abiding the current and future scenarios withstanding the drivers of growth along with holistic planning, smart tools and techniques like geospatial technology can be of greater use in the process of transformation. Open source information portals like Bhuvan-NUIS developed by Indian Space Research Organization is one such platform guiding the process of planning forward. National Urban Information System published a manual in this regard at 1:10,000 scale for thematic mapping using satellite imagery, ground data and other collateral data from various partner institutions as a source. Planning techniques like smart connectivity (using Transit Oriented Development and expressways), Smart Decision making (through holistic, inclusive and holistic planning), Smart techniques (spatial techniques for assessing energy potential of the city like Solar Energy transforming the city to a sustainable and self-sufficient city) and smart development can be implemented for transforming Chandigarh into a Smart Metropolitan Regional Development Plan.

18.11.8 Delhi Study

National Capital Region centred on Delhi is a massive but complex region. With area exceeding 45,000 km^2, the NCR is counted among the largest regions of the world. A multiplicity of plans (hierarchy plans with implications for the built environment), planned (citizens), and planners (planning organizations), the NCR is also one of the most complex regions in the country. Complexity increases, and transparency is reduced because of less use of ICT and IoT in the governance of the NCR. This chapter makes five proposals for making NCR a smart region. Governance of the NCR is taken up as the enduring challenge. It is proposed that elected regional body for the NCR is better than the existing proposed NCRPB. In this hierarchy, sub-regional planning authorities should be created by state governments for all the four states under local government acts. These will also be elected bodies. Lastly, district planning and development authorities should be set up by making a constitutional amendment to the existing DPC framework as provided in the 74th amendment act. In this line of thinking, organizations like Delhi Development Authority will have no place and must be abolished and replaced with an elected sub-regional body of Delhi Government with all powers of DDA handed over to state government. Smart spatial planning strategy is that the NCR should implement regionally significant proposals and leave local projects to appropriate agencies. Whosoever implements these projects, all projects must emanate from the hierarchy of plans, more particularly the regional plan. Third, the smart transport strategy should consider the faster implementation of RRTS and road based systems by the end of the plan period by 2021 as implementing agency is already set up. Fourth, environment and economy are entangled, but first the environmental strategy. The environmental strategy proposed, involves preparation of new energy plan based on wind and solar policy for meeting enhanced future energy needs. Lastly the economic strategy is taken up. The significance of ICT and IoT is highlighted for regional planning and development. The first thing the NCR should consider when making a smart strategy for economic growth is that it should include plans about how it could use advanced technologies for regional development. No doubt automotive safety applications, smart fleet management, and intelligent transportation systems are some of the well-known applications. There are other areas where these technologies should be considered for use such as easily available and affordable broadband internet networks are hugely important for producers as well as consumers of various services and goods. Internet of things could offer better trade opportunities if affordable broadband internet networks become available all times at all places. Most importantly, Internet of Things should be embedded in the development of physical infrastructure. The next NCR plan should consider making governance and economic policies for the development of ITC or IoT through massive public private partnerships and alliances.

18.11.9 Jaipur Study

Jaipur gained the status of a Million Plus City in 1991 [9] and was recognized as a metropolitan region in 2010. The Plans have been prepared for the metropolitan city of Jaipur on the premise of the core city and its hinterland since 1998, with the approach of four tier development system of core city, outer and inner ring of satellite towns and the intermediate rural settlements and areas. The current Master Development Plan for the horizon year 2025 too is based on the multi-tier spatial approach of the district, region, city and satellite towns. Within the regions, there are three distinct sub-regions, the urban area, agricultural area and the eco-sensitive area.

The region is covered by a thick mantle of soil and alluvium and extends towards the north and the east by hill ranges and many isolated peaks of Aravalli range surrounded by plains. Non-perennial rivers like Banganga, Dhundh, Amani Shah Nala and Bandi drain the region. Climatically the region experiences extremes of cold and heat and except for the monsoons season the weather is dry. Physiologically as well as climatically, the region is suitable for all year cultivation with some portion being double cropped. Agricultural activity is dependent on irrigation through tube wells as rainfall is scanty. Fruits and vegetables are grown in abundance. The region is rich in minerals, which is an input to many industries in the region.

After Independence, Jaipur, having the advantage of being an administrative capital and being on the major transit routes has emerged as the melting pot of various cultural regions of the state, though there is dominance Dhundhar culture. It is the cultural aspects represented in art and craft on stones, wood, leather, jewellery, clothes, paintings, pottery, monuments, food, music and dance that has helped the region emerge as a tourist centre at an international level. These cultural aspects have been patronised by the rulers of the region and have got embedded in the lives and work of the people.

The three sectors of the economy, primary, secondary and tertiary, reflect the direction of growth of a region. Jaipur's mainstay has been non-agricultural since the city was established. The city had been established as a trade and commerce centre which continues to be so till date. Over the years the city and the region have gained importance not only as a commercial hub for local handicraft but for agricultural and industrial produce.

Tourism has played a vital role in the economy of Jaipur Region, especially with Jaipur city being at its core. Other than the City, there are many locations in the Region that are important from a tourism perspective. Jaipur has attracted tourists, both domestic and international, for its city planning, historical monuments, natural features, temples, and palace complexes. Jaipur's colourful and vibrant culture which is represented in its buildings, people, dance, music, food, clothes and handicrafts is a major attraction in the region. Jaipur is an important destination on the world-famous tourist circuit, Golden Triangle, comprising of New Delhi-Jaipur-Agra. Other than the destinations within the city, there is tourist

potential in the region too, which are not as well developed and promoted compared to the locations within the city. The areas of tourist potential can be categorized into historical, wildlife, religious, traditional medicine and natural features. During the last four years, there has been a decline in the growth rate of tourist inflow, specially the domestic, while the international tourist inflow has been fluctuating [10].

In terms of the GDP, though the tertiary sector contributes maximum towards the economy, the growth of the secondary sector has been steady but slow. It is important to note that the success of the tertiary sector in the region is dependent a lot on the secondary sector as the traditional handicrafts which showcase the vibrant culture of the region is a big pull factor for the tertiary sector's tourism component.

Industrial impetus has been given in the region through planned intervention in the 1970s when the master plan was prepared to control the haphazard growth as well has direct the development of the city. The industrial activities of the region are concentrated in 14 industrial area [11] which have been set up by Rajasthan Industrial Development and Investment Corporation Limited (RIICO) and Jaipur Development Authority and unorganized industry is concentrated in and around Sanganer. Jaipur city has a large concentration of household industrial units, clustered within the walled city. The units engaged in stone cutting and polishing, blue pottery, lac work, gota work, sculptures and other traditional handicrafts. Other than this, industrial thrust is being provided by the SEZ, DFC and DMIC which implies development potential for various industries in areas between Sikar road and Ajmer Road, which is the western and south-western part of the Region.

The industrial areas in most instances have negligible industrial waste management practices as in most cases the waste is thrown at the nearest convenient location. Moreover, there are either non-functional or absence of effluent treatment plants for treating water before disposal in drains. Polluting and non-polluting industries are found to be in same industrial areas, which indicates lack of detailed planning of the industrial site. Moreover, there is total lack of planning and intervention in improving the quality of life of the traditional artists who mostly work in household industries in core city areas.

The region experiences a lower Work Participation Rate (WPR) (34%) as compared to the state (39.26%) and national (39.3%) figures, though the WPR has been increasing in the region over the past few decades [12]. Interestingly, the rural parts of the region have a lower dependent population when compared to its urban counterpart. As the city grows [13], its economic base expands due to increase in industrial activities and increase in trade and commerce resulting in higher employment. However, this trend is not sustainable and negative returns set in proving the theory that size of city or region and economic growth are negatively corelated. It has been noted internationally that metropolitan cities with high growth rates have low productivity levels.

The intriguing fact about Jaipur and its region is that the since beginning of the post-independence planning era, there have been marked deviations in its growth and development, be it related to the spatial spread of the urban area or the growth of population. The reasons have been related to a land acquisition within the planning boundary, lack of follow up actions to the master plan, like functional

plans, zonal development plans and zoning regulations and later delayed notification of the subsequent master plans. The current master plan envisaged the development of the settlements along the transportation corridors and eventually merging of the intervening areas giving rise to an amoeba shaped region with a higher concentration towards the north east, east and south. However, the settlement pattern of the last census clearly indicates the concentration of growth on the western part of the region, attributed to the external factors like Dedicated Freight Corridor (DFC) and Delhi Mumbai Industrial Corridor (DMIC). The alignment of both these corridors is at approximately 40 km from the periphery of the region.

Keeping the fact in mind that historically the city and the region has not developed as per the master plans, there is a need to take corrective actions by providing the appropriate impetus for the growth of the region.

Jaipur Region is experiencing environmental imbalance due to depletion of its natural resources and overarching influence man-made activities. Widespread deforestation mainly in the hilly areas has resulted in an increase in the rate of soil erosion due to the combined impact of wind and water erosion, a higher rate of soil erosion has accelerated the process of silting in the river channels and water reservoirs. It has further disturbed the natural habitat of wildlife and biotic process in the region. The resultant impact of deforestation, erosion, siltation, salination processes has created environmental challenges in the Region affecting the groundwater recharge resulting in lowering of the groundwater table. It has affected the micro-climate of the region as well in terms of temperature and humidity.

The influx of tourists has brought pressures on the urban fabric and infrastructure. The region has been experiencing a shortage of water supply, which is the key infrastructure requirement for any tourist activity. There is a need to assess the carrying capacity of in terms of the region is a tourist destination with a view to regulating tourist traffic.

Key issues in the region are seen with respect to its harsh climate which becomes a discouraging factor for tourists from April to August, impacting the livelihood of the population who are dependent on the inflow of the tourists. Limited water availability due to the region being in a semi-arid zone enhances the issues related to tourism and industry.

Existing industrial and commercial base in the region is one of its strongest points. To further enhance the two sectors, secondary and tertiary, there is need to introduce appropriate policy measures. The strengths of the region are its diverse minerals base, tourist potential which is concentrated not only in the city but is well distributed across the region. There is need to take advantage of the DFC and DMIC which are in very close proximity to the region.

Jaipur has been identified to be developed as a Smart City under the Government of India's Smart City Mission [14]. However, Smart City cannot be smart until it is in a smart region or else it would emerge as a semi-smart entity having a piecemeal or sectoral emphasis on its road to smartness. As established Jaipur region's core, that is its metropolis shares a strong economic and socio-cultural linkage with is region. The Jaipur region in its entirety has high potential to be developed as Smart Region. Strategies are proposed to strengthen Jaipur as Smart Metropolitan Region.

Census of India defines as Urban Agglomeration (UA) a continuous urban spread constituting a city and its adjoining outgrowths, or two or more physically contiguous towns together with or without outgrowths of such towns [15]. The UAs having a population above one million are called Million Plus Cities. Internationally, these are considered synonymous with the term metropolis. The planners understand the metropolis to be, a city governed by one or more municipal bodies, having a population above one million, and functionally serving its influence region as the dominating centre of trade, commerce, art, culture, health care, recreation, education, research, administration and political activity. A metropolitan region is the area under the influence of the development impulse of a metropolis and comprising the metropolitan core and the metropolitan periphery [16].

Cities have grown to be metropolitan regions mainly due to the concentration of industries attracting population from rural areas and other urban centres not only in the immediate influence zone of the city but from other parts of the country as well. The high rate of migration to these regions has led to overcrowding and environmental deterioration. The growth and distribution of population within the metropolitan regions are not uniform. There is a trend of corridor development in these regions along transport networks [17].

The problems that have come to be associated with these very large regions need to be addressed with the use of technology and innovation. The answers to these may lie in the smart context which has been explored in the context of Jaipur Region.

Adapting from the project management practices, the need of the hour is to make the region S. M. A. R. T., that is Specific, Measurable, Achievable, Realistic and Timely [18]. The vision envisaged for the region is smart tourism based development through appropriate industrial impetus to promote local involvement and employment to improve the quality of life and yet preserve the cultural vibrancy of the region.

Smart as per the understanding of the authors has four key elements. It should be namely attractive, efficient, digital and sustainable. In terms of a region, the place should be attractive to the citizens, tourists and entrepreneurs. It should be efficient in terms of mobility, affordability, economy and recreation. In terms of digital, it should be accessible to all to bring about smart thinking. Digital use needs to be intensive such that there is a generation of lots of data using latest and appropriate technology. The actions in the region need to be sustainable so that the future generations can meet their needs.

To achieve the vision four-point strategy has been proposed that is strengthening of regional competitiveness by enhancing tourism experience, regenerating the region's skill and knowledge base, smart industry and innovation, strategic governance for smart specialization, the key emphasis being tourism.

Tourism brings economic development and the creation of direct and indirect jobs in hotels, travel agencies, transport companies, restaurants, guides, show and entertainment business, monuments, parks and other related sectors like insurance, health, housing, human resources and training institutions. In the case of Jaipur Region, it will lead to the growth and development of industries as well as the emphasis here is on smart cultural tourism.

Smart Tourism is understood to be reliant on four core information and communication technologies: IoT, mobile communication, cloud computing, and artificial intelligent technology. These technologies connect the physical, information, social, and commercial infrastructure of tourism, and supplies Smart Tourism value to multiple stakeholders.

The authors emphasize that Smart Cultural Tourism which is technology based needs to be embedded within the framework of sustainable Tourism, Responsible Eco-Tourism and Rural Tourism for the well-integrated development of the region. Smart Tourism needs to be sustainable, that meets the needs of the present tourist and host regions while protecting and enhancing opportunity for the future by minimizing the adverse impacts of traditional tourism on the natural environment and at the same time enhance the cultural integrity of the local people and offer opportunities to the tourists for experiencing in activities that form the core of country life.

18.11.10 Kozhikode Study

Kozhikode district is located along the south west coast of India in the Malabar region of Kerala. It is bound by the Arabian Sea on the west and the districts of Kannur, Wayanad and Malappuram to the north, east and south respectively. The district is located approximately 420 km north of the state capital Thiruvananthapuram and 250 km from the commercial capital namely, Ernakulam. Chennai and Bangalore, the two other major cities of south India are located within 650 km from Kozhikode. The district—which is well connected via air, rail and road—acts as the regional transit hub for the Malabar. The two major ports Kochi and Mangalore lie within 250 km and an intermediate port namely, Beypore is in close proximity to Kozhikode—hence increasing trade prospects for the district.

Historically, Calicut was a port city and a global trading hub with an established trade route connecting Europe and South Asia. The city gradually lost its economic significance during the post-independence period due to the political and social fabric prevalent during this time. The industrial activity is presently limited to few medium scale industries related to steel processing and small-scale industries manufacturing rubber products, food and dairy, textile, handloom, timber etc. The industries are neither a major source of revenue nor does it generate any employment opportunities. Statistics from the Economic Review of 2016 prepared by the State Planning Board indicate that the economy of the district, in 2016, was primarily driven by the tertiary sector—61% of district GSVA—followed by the secondary sector—31% of district GSVA. The primary sector only contributed to 8% of the district economy wherein majority of the activities included agriculture cultivation of paddy, coconut, banana, tubers, spices and other tree crops along with fishing and its allied activities. While secondary sector activities included medium scale industries with manufacturing activities primarily focused on F&B, timber processing and tile manufacturing among others, the tertiary sector activities

included tourism and retail establishments. Additionally, many cyber parks have also been proposed for the district that is in various stages of development. With Kozhikode being positioned as the next IT destination of the state after Kochi, a potential shift in the economic base of the city is envisaged.

Economic decline, unemployment growth and high migration have made it important to reconsider economic strategies and transform Kozhikode. Low profitability of other erstwhile industry and trade activities has resulted in a structural shift in the economy from manufacturing to tertiary sector activities such as tourism, education, healthcare and IT/ITeS. The district is also home to some of the best education institutes in the country and the presence of well-developed medical facilities makes it the go-to place for health care in the region. Upcoming investments in the IT/ITeS sector include the development of a 50-acre cyber park. These developments are expected to position Kozhikode as the third IT hub in the state.

As per the results of the Census of 2011, urbanization in the district indicates that approximately 67% of the total population is defined 'urban' and the number of census areas has increased by 173% from 2001 to 2011. The growth of the urban agglomeration in Kozhikode has resulted in a continuous, vast stretch along the coast—like the urbanization pattern observed in the state. This poses a great potential for development on a metropolitan regional level. Previous planning efforts indicated in the masterplan prepared by the Kozhikode Corporation include the Interim Development Plan (1967–1981), Development Plan for Calicut Urban Area (1981–2001), Perspective Plan of 2003, City Development Plan (2006) and various town planning schemes. The various proposals in these plans range from overall district level interventions to small scale schemes, all limited to the Kozhikode Corporation area.

The metropolitan region has been defined, by both local and international organizations, as a geographic region spanning a number of local government authorities unified by economic activities, labour markets, firms and their inter relationships. It is also considered ideal if the area is within a single administrative boundary. The Kozhikode Metropolitan Region has been delineated taking into consideration these various parameters and it covers an area of 1720 km^2 with a total population of approximately 2.9 million.

In this chapter we aim to study the existing economic and spatial structure of the place and propose economic and spatial strategies that can be adapted to revive the economy of a delineated metropolitan region within the district. The economic and subsequent spatial strategies for the region have been formulated based on the principles of the Third Industrial Revolution and Zero Marginal Cost Society, proposed by Jeremy Rifkin all within the framework of the sharing economy system. The principle of sharing economy is built around sharing human and physical resources—includes the shared creation, production, distribution, trade and consumption of goods and services by people and organizations. While sharing impacts the community in multiple ways, the foundation of the sharing economy is built on trust. This fundamental principle has been adopted to integrate the community of KMR for the implementation of the various strategies. The demographic census of 2011 for Kozhikode reveals that approximately Hindu, Muslim and

Christians account for 56.2, 39.2 and 4.3% in the total population respectively. Since centuries, the Hindu, Muslim and Christian communities have practised faith based charity or compulsory donation concepts namely, 'Jajmani' (Hindu), 'Zakath' (Muslims) and 'Dashamsham' (Christians). Hence, for the community and social development these concepts have been explored—contributions when judiciously used can be utilized for the benefit of the community.

The methodology adopted for economic revival and the spatial strategies include three key steps. The first includes renewable energy generation and its deployment. All of the energy used in industries, homes and vehicles still use conventional sources that entail very high environmental impacts. In lieu of climate change and strategies adopted to reduce the carbon foot print, it becomes pertinent to carry out new models of energy production. This energy can be generated by harnessing renewable sources at nearly zero marginal cost. Internet technology and renewable energy would merge to create a powerful platform which enables millions of people to produce their own green energy in their homes, offices, and factories, and share it with each other in an "energy internet," just like we now create and share information online.

The second entails conversion of all conventional industrial activities to a smart economy i.e. a smarter means of production and consumption of products. Smart Economy involves the creation 'Prosumers,' i.e., a person would be a consumer and producer in a smart economic environment. This would involve the conversion of major economic activities to smart economic activities based on energy and resources in a region. Rather than following a conventional system of large and medium scale industries, every individual household shall be a Prosumer and would be considered as an industry. To create a 'Smart Economy' for the region, the existing economic activities of the region have been studied and declining activities/industries are identified. To replace declining activities with smart economic activities land use conversion strategies have been formulated. Identification of the potential activities in the region has been done based on energy requirement, resources, skills etc. and on the spatial codes for renewable energy. The existing activities have been converted to smart economic activities and the economic viability is assessed. The existing pattern of production services which includes 'middlemen' at every stage is transformed where in the profits to the producers will be increased by removing these 'middlemen' and increasing accessibility of the producers to the consumers—this conversion is aided by maximizing the use of ICT in every stage of the production and service system. The activities based on resources and energy has been spatially allocated and spatial codes for the smart economy is derived. The strategies to convert smart economic activities to Zero Marginal Cost have been formulated.

Thirdly, approaches to convert these smart economic strategies to near zero marginal cost have also been formulated. It is based on the idea that if the marginal cost of producing each additional item falls to essentially nothing, then everything becomes free. To create a near zero marginal cost society framework for the region, the resources in the region have been mapped out. Along with this, the religious and cultural aspects of Jajmani, Zakath and Dashamsham have also been integrated and

potential activities based on energy requirement, resources and skill are identified. The process and economic flow in zero marginal cost society have been worked out and spatial codes for a zero-marginal cost society were prepared. Finally, to arrive at the spatial code for the metropolitan region, each spatial code for renewable energy, smart economy and near zero marginal cost society has been consolidated followed by preparation of Land use plan and Zonal plan along with strategies for implementation. A knowledge based society of Kozhikode Metropolitan Region will use the implementation methods formulated based on the concepts of the Triple Helix Model for the implementation of the economic and spatial strategies.

18.11.11 Surat Study

Surat metropolitan region has many unique aspects. The region is located in the western part of India and centrally on a very important industrial corridor between Mumbai and Ahmedabad. It has an almost flat terrain and suitable land available for development. In past three decades, the urbanization has observed pace creating manifold pressure on the Government systems and natural resources in the region. There seems an apt need for a proactive, systematic planning approach for smart metropolitan region planning to infuse the fundamentals of zero-marginal cost society concept. By leveraging opportunities for changes in the planning, implementation and practices followed by citizens for various activities need to be inculcated. Collaborative efforts can lead the metropolitan for a better and perspective future

The Surat metropolitan region (considered with a geographical area of about 1500 km^2) is surrounded by the Arabian Sea on the west, the NUDA at the south and the BUDA at the east. The northern part is lacking for a declaration of any developmental agenda and is open for expansion in future. The entire area has a variety of good transportation and connectivity. Land covers show a high density of road network and developed land in the centre of the region mostly concentrated in the Suart city and its close vicinity. There are more than 300 water tanks (ponds, lakes) in the region, of varying size and storage capacities. The River Tapi is flowing from the centre of the study area, and River Mindhola is in the Southern part of the region. Both rivers traverse from the East to the West. Apart from these rivers, there exists a substantial network of streams that acts as a feeder to these rivers. The extent of available developable land is large in the Surat metropolitan region.

Following national guidelines, the region has sufficient service and social infrastructure in place considering current requirements. Electricity and communication networks are available to the citizens. Canal network is sufficient enough to cater the needs for agricultural activities. Some parts of the region are prone to flooding in the monsoon. However, administration of the region has much of overlapping by various functionaries.

The entire region is by now having established and upcoming a variety of industrial units. Most of the male workers are engaged in these economic activities, and the extent of these establishments is spreading in all directions. The region has about four SEZ in operation, many industrial estates and particular industrial area ear-marked for heavy industries of Hazira on the West.

In the recently proposed development plan keeping 2035 as a horizon year by SUDA, a care is taken for proposing ring roads (not in the city) around smaller centers where urbanization is anticipated. In addition to it, all the villages are earmarked with residential zone around the Gamtal. The larger part is kept as a residential zone. Areas are declared as industrial zones and some of these zones, specific industries are identified for development (for example, hazardous chemical industries). Also, a care is taken for connecting these places with residential areas by means of a proposed network of wide roads. A third of a kind, ring road is also proposed with an alignment. Mangrove forest zone is kept reserved along the coast line. Not extensively yet somewhat green buffers are also proposed. At a broad-level, the proposal seems good. The proposal seems lacking in terms of specific and result oriented efforts for specialized goods and services to have access to collaborative efforts. It means that development of industries is supposed to establish within a specific zone however, types of industries supporting each other are not specified at a micro level. Hence-forth the development of pockets will be at the will of the investors. It may result in farther dependencies resulting in increased transportation and logistics.

Surat and surrounding region have mostly achieved certain service level benchmarks and with rising population there will be pressure exerted on the systems in future. To avoid such circumstances, a proactive planning with a larger and inclusive purpose is very much essential. The concept of zero marginal cost society explores the aspects regarding practices over eclipse of the capitalism, cost, cooperation, IoT, and the collaborative commons. In a way, the entire concept is summed up in a regional planning perspective as to have provisions for various needs that can be best utilized with collaborative efforts sustaining and supporting each other. For achieving such, a detailed exploration of dependencies as well inter-dependencies need to be worked out. Once the levels are available in relation to dependencies, a clustering approach to planning shall be taken up to make provisions for land. At the same time, an exercise is required to visualize the ancillary needs to support these clusters as transportation, logistics, service infrastructure and social infra-structure. The clustering approach at a regional level with the provision of IoT based and monitored services, there shall be a considerable saving of time and resources. It also shall result in the increased productivity and efficient performance balancing economic and social engagements.

To achieve the state of a ‘Zero-marginal Cost society’, there will be an apt need to integrating various dimensions of sectoral and spatial planning, city and village level implementation, feedback from all citizens and in accordance, the institutional arrangements for monitoring and evaluation. The zero-marginal cost based metropolitan development not only suggest for integrating planning for various sectors but also, there will be a need to identify sector specific and intra-sector

dependencies. If done so, there shall be considerable. A quadratic sub-division of the entire region is proposed and discussed for strategic development with details. By adopting and accommodating policy and regulation reforms of national agenda, some smarter practices in work patterns need to be in place. Smarter education modes of online learning need to be promoted and sincerely included in the society. The present state of the same is limited to individual interest and willing-ness only. Smartly avoiding the physical presence of people for various tasks can result in saving the expenses in turn, can improve the prosperity in the region. There is a significant need for a pragmatic change in the planning and implementation as well as practices by citizens for smarter moves for sustaining the metropolitan region. The same can only be envisioned with the micro-level yet wholistic approach by multi-disciplinary and collaborative efforts by various levels of stakeholders.

Hence, Surat needs to be attended with a proactive, systematic planning approach for smart metropolitan region planning to infuse the fundamentals of zero-marginal cost society concept. It has potential to accommodate citizens with the offering of opportunities and serve the nation as an efficient engine of growth.

18.11.12 Naples Study

Chapter 12 "Spatial and economic smart strategies for the 21st-century Metropolitan City of Naples" is articulated in four main parts. The first part introduces the concept of economy and capitalism in XXI Century's city, starting from the assumption of Neoliberalism. Authors analyse how this ideological approach to the economy has multiplied exponentially speculation and many "distortion", both in the social system, as well as workers market: the destruction of a welfare programme, the attack to the right of the labour market and workers right, the growing powerful of financial institutions supported by the ICT powerful. Author's proposal is to find a new epistemological approach, suggesting a conceptual framework for ecological economics based on systemic principles of life and a shift from techno-city to a human city. They propose a model called homological smart city as a new way, based on direct citizen participation, peer-to-peer community, and neuroergonomics, biophilic design, and Biourban economics, all based on the human body epistemic.

The second part considers the perspective of a 21st-century Italian socio-economic renaissance to overcome a growing climate of economic stagnation. Indeed, in reaction to the crisis, several villages, towns and cities have seen a slow phenomenon of the revival of local communities. It has taken place from within the city and for the merit of grassroots initiatives of social innovation constituted mostly of young people that, leveraging on their capabilities and a peer-to-peer network supported by the ICT, promote a novel vision for the future of their community, building a more sustainable urban system able to combine the economic development of the city and its inhabitants. Through a change of paradigm, the human being is put at the centre of the system and its designing,

considering social innovators as the key-actors of change. By leveraging on local assets, they trigger a community revival process able to produce positive systemic effects overall urban system and on local governance inclusive models, promoting incremental regeneration processes.

The third part is dedicated to exploring a new Biourban strategy, named "mushrooming", oriented to consider diversification as a principle of life in a city. Biourbanism considers the city as a living organism that cannot be strictly planned but whose processes should rather be guided toward new futures. New strategies to function in a complex system like a city need to be developed by experimenting with real life situations. An experiment of open process and bottom-up urbanism was started in Finland about building a network to foster interaction between small self-organised co-working communities, considering spatial and economic processes that emerged due to it. These processes were able to activate connected diversification, recognized as a systemic principle of life that fits the context of urban development especially well.

The fourth part analyses the case of the Metropolitan City of Naples, one of the 14 Italian metropolitan cities. The Statute of the Metropolitan City of Naples divides its territory into so-called "homogeneous zones" for a more suitable, balanced and functional management of local resources, with the purpose to consider their identity characters, historical and cultural components, geomorphological and naturalistic contexts, landscapes functional interactions and socio-economic frameworks. Indeed, the concept of "homogeneous zones" is part of the metropolitan strategic plan, and is oriented to improve the territorial productivity, services to citizens opportunities, and cooperation among the different municipalities. The paper reflects on the need to identify some homogeneous zones able to underline common identity characters and activate a strategy of connected diversification, with a specific attention for the municipalities of the Coast Area of the Metropolitan City of Naples. Starting from vulnerability and resilience concepts, the study was dealt according to a multi-methodological approach, based on a GeoDesign process supported by multi-criteria analysis, multi-group analysis and spatial analysis. The elaboration of Spatial Opportunity Maps (SOMs) is the output of a multidimensional evaluation process that leads to the identification of specific territorial contexts with a greater propensity for some specializations relating to the economic sectors and the local transformation. The identification of a Biourban strategy, characterized by human smart spatial solutions, place-based and situated actions, for the enhancement of the coastal area of the Naples Metropolitan City can be considered as a prerequisite for the activation of a process oriented to the identification of "homogeneous zones", conceived not only as areas with similar characteristics but above all as territories where it is possible to promote networks of opportunities between the various municipalities and their communities. "Co-operation" is conceived a source of mutual benefit and involves a mutual convenience, based on the constant construction of ties and relationships and the interdependence determined by spatial proximity. Economic processes require cooperative-collaborative behaviours between the various components and become

increasingly territorialized, and therefore more resilient and at the same time less and less associated with the production of negative environmental impacts.

The study team offer a deep analysis of the socio-economic situation, showing all the incongruence, inequalities, environmental problems and the general unsustainability of the actual economic system. For they consider necessary a new theory and practices of smart cities and economic development. They suggest a new framework based on a Biourbanism epistemology, adopting the systemic principles of life and suggesting shifting from techno-city to human city (homological smart city) to be contrasted with the diffused idea of the smart city. Their framework offers a clear vision of what a smart city should be, and a deep concept of sustainability founded on life value. Only this epistemological revolution can permit to our society the regeneration of the socio-economic body, founded on citizens active participation and communities' involvement, respect for the nature and life. Only if we shift the paradigm, we may assure a better future, able to reinforce social inclusion, support an inclusive economy and protect the physical environment.

18.11.13 Nairobi Study

Transport and ICT connectivity will continue to play a critical role and function in metropolitan regions development, but it is not a sole panacea to unlock all their economic and growth potential. Sustainable metropolitan development will require wide consultations with all relevant stakeholders in a bid to build consensus and commitments, which should take cognizance of the complex multi-level governance associated with such regions. This should be embedded on such metro region's own competitiveness and innovations which in most cases is highly boosted by their location as knowledge and economic hubs, which is the main driver in the faster uptake of innovative ideas.

18.11.14 Abuja Study

Abuja is both the administrative and political headquarters of Nigeria. The city has an original master-plan to guide its growth, but unfortunately, the master-plan is yet to be fully implemented. Abuja being the administrative head-quarter, and centrally located too, it has been able to attract large numbers of people into the city. Abuja is a metropolitan city associated with the usual urban problems known to major cities of the world. These problems include: continuous Influx of People, in search of employment, traffic congestion, increased level of insecurity, poor and inadequate accommodation, high standard of living, poor electricity and water supplies. Many these problems were however assessed and found to be dominant especially in every part of the city. In traffic, it is a predominant problem in every part of the metropolis especially the city centre areas because of the high activities that take

place during the working days. The problem of urban sprawl whereby many unattractive suburbs keeps springing up due to poor management of the Abuja master-plan is a common problem in Abuja region. Urban sprawl has developed in Abuja because of government's unyielding to the provision of adequate housing for the large population that has moved to the city over time.

Another major problem facing Abuja city is how to control and cater for the continuous influx of migrants from every part of the country. This is evident in the increase in its population of about 2.8% per annum with a 5.5% urban growth per annum. One worrisome trend of the migration is that most people fleeing from many areas of conflict end up resettling in the metropolitan Abuja city simply because of the perceived secured environment. This can be deduced from persons of North-Eastern part of Nigeria that fled from the Boko Haram crisis and social unrests in the North, notably Bauchi, Yobe and Borno states among others, prefer to settle in Abuja due to better security apparatus that has ensured the overwhelming reduction in crime and its derivative. Although, most of the migrants are in the periphery and this is because of the lack of accommodation and/or high-cost of living in the city Centre. Also, job-seekers in search of the non-existent government jobs end up in Abuja and as they come, they also join in swelling the population of the city. The resultant effect of this uncontrollable influx of migrants could threaten the security of the residents. It has also mounted a serious pressure on public facilities in Abuja is noticeable in the following areas including transportation, housing, health, education security, and environmental challenges.

The uncontrollable migrant inflow has also led to the problem of housing in Abuja. This is because the available houses cannot meet the unending demand of houses. This has resulted in high accommodation charges especially at the city centre. The implication of this ugly trend is the spread of unattractive suburbs in the region. The problem of water supply is not left out. Water supply to some parts of the Abuja metropolis has always been epileptic in the recent decades. Sometimes, water supply to different parts of the metropolis may be disrupted for three days to enable technicians to carry out repairs on a damaged water trunk main line around Gishiri in the Mabushi District of Abuja. Usually, when this happens, residents of Wuse I, Wuse II, Garki I, Garki II, Maitama, Asokoro, Wuye, Gudu, Games Village, Karu and Nyanya would experience water supply shortages. Transportation is an essential and indispensable catalyst for activating and stimulating the pace of economic, social, political and every other human endeavour in any society. Transportation, as one of the basic infrastructures, is required for the effective and efficient functioning of urban centres. Although, despite all the efforts of providing basic transportation infrastructure, it is still inadequate because it cannot meet the growing population and Abuja depends largely on road transportation only. This therefore suggests that there is need to introduce another mode that is very effective in mass transit to ease the incessant transport problems such heavy traffic congestion, the high cost of transport, commuters being stranded at the bus stop thereby spending longer hours before getting to their various destinations. Abuja is very notorious for heavy traffic congestion which is second to Lagos in this regard.

For Abuja to really achieve the status of a smart city these problems discussed above needs to be vigorously tackled. The study suggests that one of the ways for Abuja to achieve an all-inclusive city, it must adopt the smart city concept where a smart city is viewed as a sustainable, inclusive and prosperous city that promotes a people-centric approach based on three core components—Smart City Foundation, Information and Communications Technology (ICT) and Smart Institutions and Laws. A smart city foundation is composed of three elements: urban planning and design, land policies and basic infrastructure, all of which integrate ICT into their developmental and operational architecture. The study further suggests that the city must adopt the smart city principles in the administration of the city; full and immediate integration of ICT in the city's urban planning strategies; commitment to a resilient, liveable, sustainable city underpinned by physical infrastructure that will drive a low-carbon economy; promotion of an inclusive, employment intensive, resilient and competitive economy that harnesses the potential of inhabitants; commitment to improved quality of life and development-driven resilience for all, irrespective of age, gender, religion and physical cum psychological challenges; good urban governance, a very critical element to sustainable development hence its holistic application is quite germane; build on the legacy of the Millennium Development Goals (MDGs) by providing the political will to successfully implement the United Nations Social Development Goals Compact, Post-2015 Development Agenda, and the Addis Ababa Action Agenda: 2015 (United Nations Social Development Goals (2015), United Nations Post-2015 Development Agenda (2015), UN-Habitat 2015) Addis Ababa; promotion of mobility through provision of adequate space for streets and an efficient street network that facilitates walking and cycling; co-location of residential, commercial and recreation land uses as mixed land use; provision of diverse qualitative housing units that are affordable to the urban poor and non-poor and link social and economic development with environmental protection and enhancement by making the most efficient trade-offs and appropriate choices, so that, the region's environmental assets are maintained at a level that meets the need of the present generation without jeopardizing the interests of future generations.

18.11.15 Dakar Study

From a population of about 214,000 in 1950, the Dakar Metropolitan Region has a population of 3.5 million in 2016. In 65 years, the population of Dakar has been multiplied by more than 150 times particularly during post-independence. During the colonial period, Dakar attracted massive migrations from rural areas, people coming to seek jobs in the newly built city centre. This flux had amplified after Senegal became independent in 1960 with Dakar becoming the capital giving it an additional political function. In 1985, Dakar urban population reached the one million marks for the first time making it a large city that required more sophisticated infrastructures in terms of spatial planning, transport planning, etc. It took

35 years for Dakar to reach the population of one million inhabitants in 1985 from a population of 214,000 inhabitants in 1950. But it took only 15 years from 1985 for another million inhabitants to be added to the Dakar population in 2000, and only 10 years for another million inhabitants to be added to the Dakar population in 2010. With this exponential population growth rate, the Dakar urban population will reach 5.6 million in 2030, and 7 million in 2040.

Development of large metropolitan regions like Dakar constitutes economic and social opportunities as well as challenges depending on how the urban growth was planned and managed. It provides opportunities for economies of scale and agglomeration as well as for diffusion of ideas and innovations, but it will also call for large investments in infrastructures to respond to the increased demand for water, sanitation, solid management, energy and mobility, etc. It will particularly come with increased demand for mobility that must be satisfied with an efficient public transit accompanied with increased spaces for pedestrians and cyclists to safeguard the environment while creating economic growth. The metropolitan of Dakar yet occupies a pivotal place in the national trade sector both nationally and internationally. Its autonomous ports (for coastal cities), international airports, international trade centres, touristic sites and commercial centres are assets economic growth. Most economic units in Dakar are in the commercial sector (52%). The metropolitan of Dakar contributes up to 55% of the national Gross Domestic Product (GDP). Up to nine out of ten national civil servants, and from 50 to 90% employees in national's trade, transport, banking and industrial enterprises are in cities. However, most these urban advantages are concentrated in the city of Dakar. Though the Dakar Metropolitan Region had been administratively divided into four departments, the other three departments act as suburbs of the department of Dakar, where the main commercial and administrative businesses are concentrated. The other three departments remain haunted by the early spatial and social division; they are not well planned, and they lack sufficient land allocated to streets, other public spaces, basic infrastructure and security of tenure.

However, Dakar has not been able to satisfy the employment demand, particularly from young people. In addition to that, due to a deficient urban mobility, Dakar has also not been able to create conditions for specialization. While urban agglomeration allows for job specialization, efficient market transactions and knowledge diffusion, if concentrated growth is not well planned—such as the integration of urban growth with efficient public transit investments, the resulting economic benefits tend to erode. This is the case in Dakar as in many African cities with poor connectivity leading to disconnected settlements.

Recognizing the unbalanced Dakar metropolitan regional development, in one hand, and the multiple problems associated to lack of basic services, the Senegalese government has taken bold actions to transform the urban landscape of the metropolitan region from a monocentric to a polycentric metropolitan region with the creation of urban centres to decongest the Dakar urban agglomeration. This new spatial re-organization is also accompanied by economic transformation through the ambitious economic development, the Plan Senegal Emergent. It is through key main complementary programmes, reforms and plans: (1) the Plan Senegal

Emergent; (2) Act III of Decentralization; (3) Metropolitan Planning; (4) Dakar Urban Master Plan 2035 and; (5) Digital Senegal Strategy 2016–2025. These urban policies and programmes aim to spatially and economically transform the Dakar Metropolitan Region to be smart, sustainable, inclusive, resilient and prosperous. They aim to transform the monocentric system to a polycentric system where every urban centre equally contributes to the development of the metropolitan region.

Another urban development is the emergence of urban corridors, which present a type of spatial organization with specific economic and transportation objectives. In Senegal, the government is also encouraging growth, convergence and spatial spread of geographically linked metropolitan areas and other agglomerations. These are emerging trends linking Dakar-Thies-Mbour, turning into spatial units that are territorially and functionally bound by economic, political, socio-cultural, and ecological systems. It expected that the Dakar master includes Thies and Mbour. Though their economic output may be enormous, their management requires considerable investment in infrastructure, particularly to ease mobility and communication to constitute a large economic output, combining large markets, skilled labour and innovation.

Along the transformation of the Dakar metropolitan regional development, national authorities have put in places planning guidelines through the Urban Master Plan of Dakar (Plan Directeur d'Urbanisme—PDU) 2035 and National Plan for Territorial Development "PNAT". The PDU 2035 aims at the urban development of the region of Dakar and its surroundings by 2035. Its main objectives are: Sustainable Urban Development; Compact cities connected with a transport network; Robust and Resilient city and; a Vibrant city with active interaction between information, goods and people. The PNAT proposes five development urban areas: Multifunctional urban areas; Areas for economic activities; Areas for agriculture activities; Areas for touristic activities; and Areas for conservation. The PNAT also identifies areas with high risk for habitation and any other activity. In these areas, modification of the land including by residential structure, or any cadastral operations is prohibited. This plan promotes green areas and other protected areas for environmental purposes or spaces with light recreational facilities, which, when well-integrated enhance the character or the ecological value of the area. Specific focus areas of the PNAT also aim at: controlling the internal urban growth; reducing the proliferation of slums; promoting a balanced urban development; and meeting the housing demand.

It is in the ICT revolution momentum that the government of Senegal has initiated the creation of urban centres on the outskirts of Dakar in order to decongest the city. The government is, indeed, putting in place an ambitious project of a technology park in Urban Pole of Diamniadio, called "Diamniadio Technology Park". The park is based on the Silicon Valley model and intends to promote data revolution and higher education centres. The Urban Pole of Diamniadio is also among the pilot cities of the National Sustainable Cities Initiative (SCI) as part of the Sustainable Cities Programme launched by the Global Environmental Facility (GEF) in 2016. It consists of "Planning and Managing the urban pole to decongest Dakar and to be a sustainable city model connected to Dakar and the rest of the

country through walking, non-motorized, ICT means". Under the Sustainable Cities Initiatives, in addition to developing transport infrastructure, the government of Senegal has also introduced the model of multiple connectivity choices (non-motorized, motorized means of mobility and ICT).

18.11.16 Johannesburg Study

Johannesburg metropolitan region is part of the Gauteng Province, The Gauteng Province has developed a Gauteng City Region that covers the Johannesburg metropolitan region and the city of Pretoria which is spatially and economically linked to Johannesburg but is not part of the Johannesburg Metropolitan Region. The city of Pretoria is the administrative capital of South Africa and is part of the Gauteng Province, Urban Policies and Programmes are made under the Gauteng City Region including the metropolitan and the administrative capital.

From a population of 26,303 in 1890 to 102,078 in 1896, Johannesburg located in the Gauteng province, is the largest city in South Africa and is one of the 50 largest urban areas in the world. The population of the Greater Johannesburg Metropolitan Area including suburban regions such as Ekurhuleni, the West Rand, Soweto and Lenasia is over 10 million making it a megacity. Since the end of the Apartheid, Johannesburg has become the main destination for migrants from other South African provinces as well as from other African countries. One third (35%) of Gauteng residents were born in other provinces or in other countries. The Greater Johannesburg Metropolitan Area represents 14% of the national population. It is an engine of South Africa with a share of 18% of the national GDP which itself represents 24% of the African GDP. This is the reason Johannesburg is considered a global African city. Johannesburg also scored the Human Development Index in the country.

Johannesburg was the centre of the apartheid regime in South Africa that lasted from 1948 to 1990 and has been named as being among the unequal cities in the world. The City Foundation of Johannesburg has historically been guided by a segregationist ideology manifested through institutions and laws, urban planning and design, and access to basic services and amenities. During the Apartheid, most township areas designated for non-white people were situated between 25 and 30 km away from the central business district, leading to significant transport challenges. The dismantling of apartheid in the early 1990s came with calls for inclusive development in South Africa. Different models have however been adopted to make the city more inclusive post-apartheid, the key ones being on participatory planning and design; development of inclusive public spaces; improvement in basic infrastructure provision and public transport particularly to the poor neighbourhoods and; development of policies that encourage inclusive human settlement and trade.

Today Johannesburg is in the Gauteng province. The province itself is developing City Region projects that cover: the city of Johannesburg, Ekurhuleni Metro,

West Rand District, Sedibeng District Municipality and the City of Tshwane. Under the cluster of cities of the Gauteng city region, the city of Johannesburg is the Financial Hub, the Ekurhuleni Metro the Manufacturing Hub, the West Rand District the agribusiness/agroprocessing and green and blue economy, Sedibeng District Municipality with the New economy to be anchored on steel, Vaal river, tourism, agriculture linked to Sasolburg, and the City of Tshwane being the Administrative Capital has become a key driver of knowledge, innovation and automotive industry development. The Gauteng city region promotes spatial transport transformation through Metropolitan BRT Systems, Metrorail Upgrade and Gauteng Freight and Logistics Hubs.

In addition to the city-region projects, cities themselves are also developing their specific sustainable urban development projects and programmes. For instance, to ease management of municipalities, the administration of city Johannesburg is now decentralised into 7 regions following the creation of the post-apartheid City of Johannesburg Metropolitan Municipality in 2000. "Each region is operationally responsible for the delivery of health care, housing, sports and recreation, libraries, social development, and local community-based services. Each region will develop its own Local Integrated Development Plans (LIDPs). A LIDP guides a region's future development. While they deal with local issues, they take an integrated approach to issues such as transportation, housing and environmental management".

Despite several urban policies and programmes put in place for an inclusive sustainable urban development in Johannesburg, the metropolitan is still facing enormous challenges such as slow economic growth marked by High Unemployment rate, particularly among young people; Exclusion of poor communities from access to housing and land; Mobility is still a challenge for the urban poor; Urban violence and insecurity; and Climate change with Johannesburg being ranked 13th in the world of Greenhouse Gas (GHG) emitters and largest GHG City in South Africa.

Considering these challenges, the City of Johannesburg has put in place a holistic smart city programme to be implemented at 85% by 2021. This programme encourages innovation and efficiency; preservation of resources for future generation; resource sustainability with, for instance, 30% diversion in waste disposed of by landfill. For the year 2017/2018, the city of Johannesburg has elaborated ten points for urban development including to: (1) ensure that the entire City embraces the environment of a new coalition government; (2) Promote economic development and attract investment towards achieving 5% economic growth; (3) Ensure pro-poor development that addresses inequality and provides meaningful redress; (4) Create a culture of enhanced service delivery; (5) Create a sense of security through improved public safety; (6) Create an honest and transparent City that fights corruption; (7) Create a City that responds to the needs of residents; (8) Enhance financial sustainability; (9) Encourage innovation and efficiency through programmes such Smart City and; (10) Preserve our resources for future generation.

Five pillars are the bedrock on which these ten points will be delivered:

PILLAR 1: Grow the economy and create jobs
PILLAR 2: Enhance quality of life by improving services and taking care of the environment
PILLAR 3: Advance pro-poor development that provides meaningful redress
PILLAR 4: Build caring, safe and secure communities
PILLAR 5: Institute an honest, responsive and productive government.

At the spatial level, the transformation of the city of Johannesburg will consist of:

1. Compact city—combining density, diversity, proximity and accessibility, reducing distances, travel times and costs, bringing jobs and social amenities to single use, marginalised residential areas, reducing energy consumption and infrastructure costs.
2. Inclusive city—ensuring balanced service provision (hard and soft) and opportunities for all by diversifying land uses, promoting social mixing and bridging social, spatial and economic barriers.
3. Connected city—enhancing public transit and ICT infrastructure at provincial and urban scales to re-connect the city, starting from 'the Corridors of Freedom' to the street and neighbourhood-level connectivity.
4. Resilient city—building a metropolitan open space system as a protection buffer, preserving valuable green infrastructure and areas of high agricultural potential, promoting sustainable energy use, reinforcing the urban development boundary and protecting biodiversity resources.
5. Generative city—focusing investment in transformation areas and nodes towards: achieving positive social, economic and environmental returns on investment; spurring economic growth and job creation and enhancing public space and promoting sustainability (social, environmental and economic).

18.11.17 Pittsburgh Study

The mid to late 20th century rust-belt cities in the US witnessed a trend of decline in its manufacturing base with global shift of industrial production to the developing parts of the world and the New International Division of Labour (NIDL). As a result, the rust belt cities were compelled to rethink their urban and economic development strategies to compete in the New Economy of the 21st century. An increasing trend of adopting economic transformation plans was witnessed among the rust-belt cities with the varying trend of success. The common theme of these plans was to replace the manufacturing jobs with advanced service and technology-based jobs. However, there were more challenges than opportunities in the process of doing so, which set the context of urban and regional planning practices in the rust-belt cities.

Pittsburgh, one such example of a rust-belt city, was once known as the "Steel City" due to its production capacity of raw steel in the world economy. The

abundance of natural resources, such as coal, timber, iron, and limestone, and navigable waterways—the Allegheny and Monongahela rivers, helped Pittsburgh emerge as the centre of steel industries in the US in between the late 19th- early 20th century. With such comparative advantage of natural resources and navigable waterways, the city burgeoned with large-scale steel mills since the 1870s that produced one-third to half of the total steel production in the US by 1970s, and grew additionally with an economic and population base to support steel-production activities. Nevertheless, the city's steel production declined with an international shift of steel-manufacturing activities to India and China in the 1980s, and led to several consequences, such as economic and population decline, massive brown-field sites, and vacant and abandoned properties. The planners and policy makers had no choice but to focus on adopting newer sets of strategies that could transform Pittsburgh from a shrinking city and make it competitive. The late 20th century Pittsburgh increasingly became successful in adopting many bold policies and strategies that transformed its local economic base towards advanced service sectors: healthcare, higher education, technology, research and development, banking and finance.

Pittsburgh is a tail of two eras in the history of American urban planning. In 1950, Pittsburgh's polluted air, riverine environment, sprawling working class, and tangled maze of streets and bridges had singled it out as one of the most blighted and reviled cities in Americas. A private-political alliance arose in the early 1950s that gave birth to one of the earliest efforts at what we have come to know as the era of urban renewal. The early years of the Pittsburgh's Urban Renewal Authority were years of clearance and demolition. Pittsburgh's "Renaissance I" began with the Point Park and Gateway Centre project. Point Park at the confluence of the Mon and Allegheny rivers was an area of blight and flooding. With the financing of the Equitable Life Assurance society, a thirty-six-acre park and a twenty-three-acre redevelopment site became known as the Gateway Centre. Between 1950 and the 1960s seven high rise office buildings, a Hilton Hotel, a residential apartment building, and an underground garage filled the once blighted space. In the Eisenhower era of demolition and highways, the URA set its sights on the Lower Hill district, a predominantly African-American neighbourhood. The development of a convention centre and arena ultimately displaced 1300 buildings, 413 businesses, and 8000 people from the Hill. The population of the Hill fell from 17,334 in 1950 to 2459 in 1990. The loss of a stable black neighbourhood and the concentration of emigres in larger black neighbourhoods contributed to making Pittsburgh one of the most segregated cities in the country.

Failure of urban renewable efforts and continuing trend of manufacturing decline deeply impacted Pittsburgh through the 1980s, 90s and 2000s. The region sharply lost more than 133,000 manufacturing jobs within only 8 years, in between 1979 and 1987. This led to an era when communities after communities experienced financial difficulties and struggled to bounce back in the New Economy. In between 1987 and 2004, 5 municipalities in the Pittsburgh metropolitan region including the City of Pittsburgh were identified and listed as distressed communities experiencing "severe" financial difficulties under Act 47 of 1987, the Municipalities Financial

Recovery Act of Pennsylvania; placing them under State assistance for recovery strategies.

The 1990s and 2000s also brought a change in the planning and a change the URA's approach to renewal. The early efforts at renewal still left large areas of abandoned factories and decaying neighbourhoods. Although federal level programs provided funding and strategy-framework to clean up contaminated sites, the stigma associated with real or perceived levels of contamination often posed difficulty in successful redevelopment of brownfield sites. But in planning's new paradigm, brownfields are also treated as an "opportunity". Local governments today to restore the vitality of urban life have turned to a notion of redevelopment that includes infill, mixed use, a private-public partnership, walkability; a framework of smart growth. Thus, at the turn of the 21st century, Pittsburgh witnessed a significant change in its planning approaches, shifting towards a bottom-up approach, and proliferation of neighbourhood level community and non-profit organizations. This was coupled up with remarkable progress with its economic restructuring process, heavily relying on the growth of hospitals and healthcare services, high-technology industries, canters of research and higher education. Interestingly, most of these sectors are non-profit sectors and are property tax-exempt, contributing to financial challenges for the local governments.

The 2010s planning approach brought further changes by aligning smart growth ideas with smart city practices. While the notion of Smart City is a relatively new paradigm in planning, the concept of Smart Growth has remained in the planning arena since the late 1990s. Essentially, smart growth is based on mixing land uses, using land and infrastructure efficiently, creating walkable neighbourhoods that are attractive and distinctive, providing transportation and housing choices, and encouraging community and stakeholder collaboration in development decisions. While the concepts of Smart Growth do not emphasize on the dependency of ICT systems, the essential softer domains of Smart City concepts, based on environment, equity and economy, are visibly present in these aspects. Recently, smart city approach has gained much popularity in the US, and Pittsburgh is fast emerging as one of the leading cities in the US in this area.

We specifically illustrate Pittsburgh's strategies of Smart City through many planning initiatives at a local and regional scale, where efforts to (1) plan for economic resiliency and redevelop brownfield sites, and (2) green infrastructure led to creation of a mix-use neighbourhoods, green spaces and diverse economic opportunities that overall contributes to improved quality-of-life of the residents.

Pittsburgh's economic resiliency plans since the 1980s, strongly focused on clean-up and redevelopment of old brownfield sites. Successful redevelopment of brownfield sites, which were idled and abandoned with closures of steel mills in the region, is considered one of the key factors of post-industrial economic restructuring in Pittsburgh. Most of these cases of brownfield sites happened with public-private partnerships among URA, Port Authority, and other public agencies and private developers. Case studies of Brownfield redevelopment sites demonstrate the use of financial tools such as Tax Increment Financing (TIF), and others. The public investments are largely spent on environmental clean-up (tar pits, waste

oil, and ferrous cyanide), site remediation, and open space creation, mainly because of the reluctance of private companies to take up such responsibilities. Many of the successful brownfield site redevelopment is also close to the University of Pittsburgh and Carnegie Mellon University campuses; which enabled collaborative cooperative research efforts between the top ranked national universities and the business community spurring the growth of high-tech jobs in the region. An example of the Eco Innovation district, an economic resiliency and brownfield redevelopment plan that intends to revitalize Uptown Pittsburgh and transform it into an innovative urban ecosystem where it will enhance equitable land use, attract and guide new investment, expand the local economy, reduce the city's environmental footprint, and ensure equity and access to local opportunities. This plan is being developed by a series of local and regional stakeholders. This is with collaboration among several agencies including the Uptown Partners of Pittsburgh, Oakland Planning and Development Corporation, City of Pittsburgh, Sustainable Pittsburgh, Urban Redevelopment Authority of Pittsburgh, Port Authority of Allegheny County, and Allegheny County Economic Development, neighbourhood residents and groups, universities, and other partners. Such strategies of transforming large-scale brownfield sites into employment generating areas, specifically high-tech and innovation oriented jobs, have helped change Pittsburgh economic base from steel-manufacturing to higher education, medical research, banking, finance and high-tech sectors.

Like many rust-belt cities, Pittsburgh has a considerably large number of vacant, distressed, or undeveloped properties. In a post-industrial context, urban greening has the potential for returning surplus and derelict lands to productive uses, reduce surplus lands, and stabilize real estate markets. These lots are a legacy of Pittsburgh's economic shift which resulted in a large amount of vacant and distressed lots which create several issues such as a decreased tax-base, public health issues, social isolation, environmental hazards and overall a lower quality of life for the surrounding neighbourhood. 12% of all properties in Pittsburgh were vacant in 2000, 36% of which were abandoned or blighted. These distressed sites include parcels that are currently vacant, condemned, or tax-delinquent. These properties that have become public responsibility places an enormous burden on the City resources and do not contribute taxes to pay for public services. In 2015, it was estimated that there were over 28,000 vacant lots could have cost the city about $20 million to maintain, of which the city-owns about 19% by area. Community gardens, landscaped spaces and other strategies are practiced at the local levels to enhance the quality of life and foster socio-economic and environmental sustainability, which are an integral part of smart city approach. An Adopt-A-Lot program is being implemented since last year which aims to convert these lots from blight to asset. Adopt-A-Lot is a low-cost smart city initiative to fight blight, since maintaining each one of those vacant lots would cost the city almost $600/year, amounting to over $5.6 million for maintenance of only the city-owned lots.

Pittsburgh's storm water and sewage infrastructure built before the 1940s relies on a Combined Sewer System (both sewage and storm water is designed to be carried in the same pipes), so when storm water exceeds the capacity of the pipes,

untreated sewage mixed with storm water overwhelms the system and overflows at several points before it reaches treatment plant. This results in increased flooding, water quality degradation, stream erosion, reduced groundwater recharge, and loss of aquatic life. Therefore, there is a need for more resilient infrastructure to handle the environmental problems due to untreated sewage and storm water. Older infrastructure with combined sewer and storm water system is not only inadequate to handle current needs, but even more ill-equipped to meet future demand due to changes in the climate, land use, and rainfall patterns. Green infrastructure (GI) techniques such as rain gardens, riparian buffers, and porous pavements have been proven to be effective for reducing the volume, the rate, as well as pollutants of storm water runoff. It is interesting to note that Pittsburgh has moved to implementing smarter, cost-effective, GI techniques to reduce the overflow of sewage into its rivers during wet weather events, moving away from the traditional, strictly gray infrastructure approach. This is expected to keep one billion gallons out of the combined sewer system annually, dealing with approximately 10% of the storm water problem in Allegheny County under current conditions. Other benefits of GI include cost-effective public realm investment, re-establish riverfront connections; complete streets design approach fostering healthy, walkable communities and; creation of resilient infrastructure. But as the climate changes, larger storms and increased rainfall are expected in the area, there is a need for a more dynamic plan with resilient infrastructure.

Pittsburgh has demonstrated a commitment to renewable energy and wants to use cleaner sources of energy because it is vital to creating a more sustainable city. Each year the City of Pittsburgh purchases 25% of its energy from renewable sources, which is enough to power 3500 homes per year. Renewable energy is generated from resources that are indefinitely replenished naturally: sunlight, wind, water, hydrogen, biomass, and geothermal heat. In 2007, Pittsburgh signed the U.S. Mayors Climate Protection Agreement, committing to implementing local climate protection solutions which will result in reduced taxpayer dollars and energy use. Pittsburgh's first greenhouse gas inventory was undertaken to measures the amount of GHG emitted from various sources, which is useful to target actions having the most impact. Pittsburgh is already experiencing climate change effects with colder winters, and Pennsylvania can expect longer and hotter summers, decreased winter snowpack and increased rainfall. Pittsburgh will face local climate threats such as increased severe weather events and flooding, higher prices and a shortage of basic goods, increased rate of illnesses and other heat-related health problems. Currently, Pittsburgh is in the process of developing its third climate action plan (PCAP 3.0) to create policies and projects to reduce greenhouse gas emissions within city limits to reduce the severity of regional impacts and move towards a low carbon economy. Further, the city of Pittsburgh, affiliated agencies, and the Green Building Alliance have been working on their Green Garage Initiative to retrofit lighting to LED technology in city owned buildings. After retrofitting the city garages buildings in January, city garage buildings saw a reduction of approx. 60% cut in energy consumption and costs. Also, the city and partners are working towards developing a lighting infrastructure fund for other municipal and privately-owned garages.

In summary, several challenges can be outlined in the Pittsburgh's efforts of economic transformation and brownfield redevelopment. One of them is related to the large-scale brownfield sites that still dominate the urban landscape of the region, and requires an enormous amount of financial resources for economic transformation. A city's tax base can never to sufficient to address these issues in a short span of time, and Pittsburgh needs to continuously re-invent and re-innovate its strategies for brownfield redevelopment at the metropolitan scale. Most of the success stories are concentrated within the Centre City that is near the Universities, Research Centres, and Interstates; while the locations in the broader region farther away from the centre-city are still struggling to comeback. Municipalities, such as Braddock, which are still struggling with brownfield issues along with aging population and infrastructure, are adopting more right-sizing strategies and planning for shrinkage by converting abandoned properties into open and green spaces that can reduce the cost of maintenance and create a better living environment. However, this will remain a challenge for these communities to attract jobs and human capital in the short-term.

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