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SMART CITIES MOVEMENT IN BRICS

Edited by
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Contents

Editor's Note

BRICS nations are today cooperating on numerous matters of mutual concern. The cooperation is the result of years of deliberation, hard work and commitment. Since the formation of the grouping in the mid-2000s, various important activities and events have been initiated. Especially significant among these are the holding of a series of high-level inter-governmental meetings and yearly summits, formation of an independent organisation, the BRICS International Forum, and constitution of the New Development Bank.

The association aims to work towards strengthening national economies and offering support for the achievement of development goals. In this endeavour, BRICS engages with non-state actors (such as a network of non-governmental organisations, as well as think tanks) for receiving policy inputs and advice on topics of mutual interest.

The BRICS agenda has considerably widened over the years. From issues which are purely economic and strategic in nature, the group is now engaged in a range of public policy issues. Urbanisation is one such area receiving growing attention. The recently concluded 8th BRICS Summit hosted by India during its presidency in 2016 calls for enhanced cooperation to deal with the multi-dimensional challenges and opportunities of urbanisation. In particular, emphasis is laid on strengthening urban governance, making cities safe and inclusive, improving urban transport, financing of urban infrastructure, and building sustainable cities (Goa Declaration, Point 97).

Globally, the need for understanding and responding to emerging problems in cities and urban agglomerations has become more important than ever before, for which the reasons are obvious. At many places, the prevailing situation is disturbing, observed from the growing social and economic inequalities, deteriorating living, spatial and environmental conditions, racial and migrant discrimination, politics over community polarisation, and rising civic unrest and insecurity. Such adversities are severely disrupting city life and the economy, and call for urgent interventions. Considering the opportunities created by urbanisation, greater efforts must be made to manage the phenomenon.

Of late, the concept of 'smart city' is gaining popularity. It is an evolving idea constantly being refined by various stakeholders, who suggest that when designed and applied properly, it can help overcome numerous city-level problems. The idea builds upon previous reform efforts and includes new elements to tackle challenges—such as the creation of specialised entities and the use of digital technologies in an integrated manner.

Governments of many countries are revising their governance agendas and practices in the light of the smart city concept. For example, smart city governance practices are increasingly being used in many parts of the world. Similarly, India launched the Smart Cities Mission in June

2015, with the aim of improving living conditions and achieving higher economic growth in 100 urban centres across the country.

This publication attempts to offer policy inputs for making smart cities. It is anticipated that the governance research methodologies and urban reform measures described in the publication will enrich understanding of the smart city concept, and help stakeholders in designing effective planning and governance strategies.

The publication is an outcome of a Conference on Smart Cities organised in Jaipur (Rajasthan, India) from 17–19 August 2016 by the Observer Research Foundation (ORF) in collaboration with the Indian Ministry of External Affairs (MEA) and the Jaipur-based Sardar Patel University of Police, Security and Criminal Justice. The conference brought together an interdisciplinary group from the BRICS nations. Over 30 experts representing government, education and research institutions, think tanks, civil society and the private sector participated in the conference and presented numerous perspectives on urban development and smart cities.

The Hon'ble Chief Minister of Rajasthan, Smt. Vasundhara Raje, graced the occasion and described prominent smart city measures underway in the State, including the introduction of labour laws, skills and livelihood development programmes, and the preservation of culture and heritage.

The knowledge and ideas shared during the three-day programme indicate a gradual movement towards the making of smart cities in BRICS nations.

Included in this volume are 17 papers presented by experts during the conference. The papers contain information on select urban topics studied by the experts in their respective cities/countries over a period of time, and are arranged by themes, i.e., policy and governance; research methods; financial resources; people's participation; public safety; public services; and environmental sustainability.

Jijun Chen describes China's new-type urbanisation plan and provides an account of smart city pilot projects implemented in different cities. Also discussed are the various financing options for projects.

Ana Paula Bruno expresses concern over the possibility of applying the smart city concept to Brazilian cities in the light of existing deficiencies in policy, planning, data and technology.

Zhenqiang Xu builds upon China's experience in making smart cities to offer ideas for BRICS governments. Reference is made to smart projects implemented in different urban centres.

Yang Li explains the smart actions taken in Shanghai, which include building of advanced urban information technology and cyber security systems.

Vladimir Korovkin uses the example of Russia to present a quantitative measurement of the depth of penetration of digital technologies into the life of modern cities. Stress is laid on moving from primary to secondary level of digitalisation.

Bárbara Oliveira Marguti highlights the significance of creating and using interactive technological platforms, such as Brazil's Human Development Atlas and the Social Vulnerability Atlas, to design better policies and thus overcome socio-economic inequalities.

Bernardo Alves Furtado, Isaque Daniel Rocha Eberhardt and Alexandre Messa report on the advantages and limitations of using a simulation model as a policy tool to empower governance.

Daniel da Mata analyses the drivers of urban revitalisation programmes in the context of Brazilian cities and expresses the need for improving the quality of local bureaucratic personnel.

V.N. Alok and Ashutosh Vashist offer ideas for successfully tapping into funding sources to implement India's smart cities mission.

Kedibone Phago presents a model for smart governance that relies significantly on public engagement. Access and use of technological devices, internet services and social media platforms to facilitate meaningful engagement, as well as managing information, are prerequisites according to the author.

Andrey Belozerov demonstrates how Moscow city government is using technology to engage with the residents and provide basic services based on the inputs received.

Rute Imanishi Rodrigues discusses the increasing use of the internet and social media by residents of Rio de Janeiro to report police brutality and other misconducts by authorities. Such information, according to the author, can be the basis to map and respond to violence.

Kanchan Gandhi examines the need for a multi-pronged approach to women's safety in Indian cities. Reference is made to the problem of patriarchy, the need to sensitise the society and governing institutions, and paying attention to micro-level urban planning measures.

Chéri Green and Gerbrand Mans describe a rational approach to the planning of social facility provision. A case study application in Cape Town is used to illustrate the application of the methodology of spatially matching supply and demand for facilities using GIS tools.

Carlos Henrique Ribeiro de Carvalho presents the results derived with the implementation of a public transport policy for low-income, formal-sector workers in Brazil's major cities.

Alessio Russo and Giuseppe T. Cirella share research that investigates the exploratory ideas of potential ecosystem services provided by biophilic cities, such as improved air quality, CO_2 reduction, microclimate benefits, flooding mitigation and superior water quality, food production, and economic benefits.

Finally, *Alexey V. Parnyakov and Valery A. Savostenko* showcase a series of international friendship park projects to make the point that such participatory design exercises help in improving relations between countries.

The most important lessons emerging from the papers on how cities can be made smart are presented in the first paper. Towards the end, the publication provides the list of speakers at the conference, biographies of contributing authors, and a brief note about the conference organisers.

To conclude, making cities smart is a collective responsibility. A good combination of non-state and state players can show the way. It is ultimately for the political leadership to give greater priority to improving cities, harnessing the available potential, and demonstrating excellence in governance.

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1

Policy Recommendations for Making Smart Cities

– RUMI AIJAZ –

BRICS countries are home to over 1.5 billion urban residents and account for as much as 40 percent of the world's urban population. Individually, these countries (Brazil, Russia, India, China and South Africa) are experiencing urbanisation at a varying pace (Figure 1). While the absolute urban populations of China and India are huge (between 400 and 800 million), the share of urban population to total population is high in Brazil, Russia and South Africa (between 65 and 90 percent). Thus, China and India are comparatively less urbanised, with significant proportions of the population living in rural areas.

A prominent urbanisation trend is the imbalance in distribution of urban population within each BRICS country, and growth in the number of cities. Existing cities have been attracting population, investment and economic activities for long and thus, their densities are increasing by the day. Several medium-size urban settlements are also moving up in the urban hierarchy and

Figure 1: Urban Population in BRICS, 2015
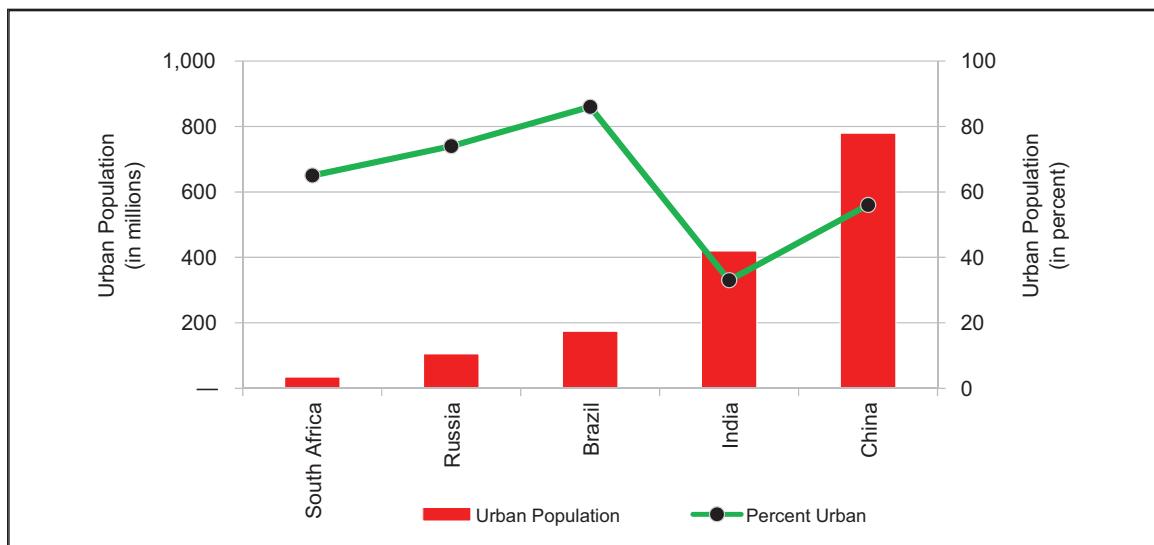
Source: UN Population Division. World Urbanisation Prospects: The 2014 Revision.

being reclassified as cities due to increases in their population and changing characteristics. The numerous policy and plan interventions being occasionally made to restrict growth in existing cities and urban agglomerations have met with little success. At the same time, there is a growing belief that the full growth potential of existing cities remains underutilised, and considering their significance for the nation and the society, there is scope for accommodating further growth in such cities. Another recent trend is the creation of brand new cities.

The growing focus on promoting city-led growth and development calls for the application of smart strategies to develop, manage and run cities of the future. BRICS nations possess rich knowledge, skills, resources and technology. Identification and judicious utilisation of these assets can help greatly in addressing the common set of city-level challenges confronting BRICS and in moving towards the goal of making smart cities.

Creating smart cities can be said to be a highly challenging exercise. It requires rational and participatory decision and policymaking, sound urban planning and project formulation, effective enforcement of laws and implementation, integration and management of numerous city sectors and services, use of digital technologies, resource mobilisation, and capacity building of city-level functionaries. Equally important in this effort is community sensitisation. Essentially, the objective is to create sustainable and economically strong urban centres that can offer an improved quality of life to all sections of society and meet their requirements in a desirable manner.

The following recommendations would be useful for any exercise dealing with smart city policymaking (also see Figure 2).

1. **Establish specialised entities, sponsor programmes and industry alliances**: For facilitating the smart city development process, it is necessary to put in place a specialised governance architecture and engage with expert stakeholders. In China, for example, smart

Figure 2: Topics on which recommendations are provided in this publication
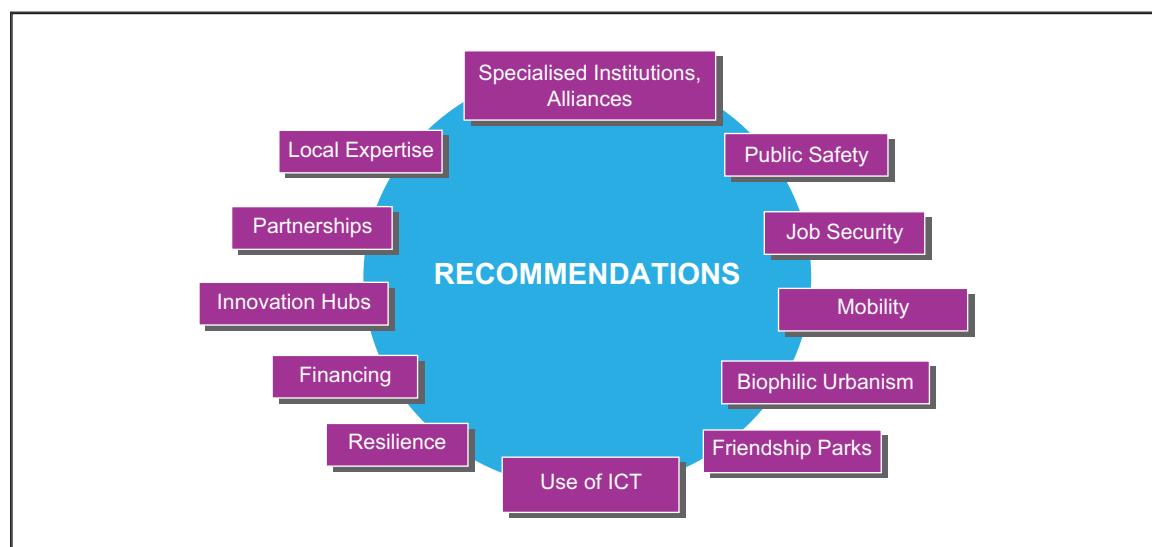
Source: Author's own.

city pilot projects are led by the Ministry of Housing and Urban and Rural Development, which encourages setting up of smart city organisations and promotes industry alliances. Several ministries have also established the smart city inter-ministerial coordination mechanism and a working group to coordinate and solve cross-sector, cross-domain problems during the process of smart city construction.

2. **Improve expertise of local bureaucracy through training**: Greater efforts should be made to improve expertise of local bureaucratic personnel and elected representatives through training for better revenue mobilisation and successful implementation of urban development projects. Training courses should offer up-to-date information on methods to be used for dealing with contemporary and future urban challenges. Necessary support should be provided to the functionaries for effective implementation of lessons learnt during training. This publication includes a study of Brazilian municipalities which shows how funding innovations for urban development projects may not be effective, as the low level of bureaucratic expertise prevents local governments to meet the complexity of non-traditional funding. The study also observes varying levels of motivation among the personnel to implement urban programmes.

3. **Engage more with non-State actors**: Committed NGOs and private-sector organisations working independently for the welfare of people and the city should be identified and engaged in the urban restructuring process. The Aajeevika Bureau (an NGO headquartered in Rajasthan, India) provides a range of services to migrants and their households, including registration of migrant workers and issuance of identity cards, skills training and placement, and legal aid, among others.

4. **Build resilience by capturing and attending to city diversity**: Smart city plans should be based on the social and cultural diversity prevalent in cities and must contain directions for managing critical urban sectors, such as peri-urban informal growth, housing for the poor, traffic congestion, rights of migrants, flooding, and disaster management.

5. **Mobilise funds from a combination of sources**: Availability of funds is essential for successfully implementing development projects. It is often said that since budgeted funds alone will not be enough, other modes of financing will need to be explored. In China, funds are being made available from a combination of sources, including government funds, bank loans, and enterprises' own funds. In this way, smart city pilot projects become eligible for funding from an investment fund sponsored by the State-owned China Development Bank. Investment from local government and private sources is also growing. The future work focusing on smart city financing in China is expected to include: establishing a market-oriented operation mechanism; nurturing full participation of enterprises and social capital and establishing smart city credit rating systems. In addition to raising funds in innovative ways from within each country, the possibility of obtaining loans from the New Development Bank should be explored.

6. **Create career opportunities for the jobless**: Unemployed youths should have access to registration on government database and should be identified, trained and assisted in starting various types of income generating activities/self-employment ventures.

7. **Build innovation hubs**: Knowledge of vocal, creative, digitally active citizens can be effectively utilised in city management by creating public spaces where citizens and the administration can discuss problems with entrepreneurs and find suitable solutions.

8. **Create biophilic cities**: To challenge environmental issues — such as urban heat island effects, CO_2 emissions, soil sealing, biodiversity loss, exploitation of natural resources, air, water and soil pollution, and climate change — a biophilic planning approach is needed, where nature is carefully integrated into city planning and development. For example, development of green areas and green buildings can help in improving the aesthetics, environment and overall quality of life of its residents. Simultaneously, more investments and new financial instruments to support smarter urban infrastructure and technology are needed. In China, about 40 percent of cities are becoming resource exhaustive (e.g., coal reserves are declining, as are water sources and green areas) due to uncontrolled exploitation by industries and, thus, facing different levels of ecological security problems. A concern for the environment led to laying greater emphasis on maintaining a balance between ecological security and economic development. Thus, some cities are promoting and investing in non-polluting industries (e.g., agro-based, finance, tourism, logistics, high tech, IT).

9. **Create international friendship parks**: Parks can be a symbol of good relations between the BRICS countries. These can give opportunity to students, architects and designers to come together, express themselves, show their creativity and bring to fore the ideas of peace and friendship. The Soul and Soil Park in Vladivostok (Russia) has a wooden arch and amphitheatre, among other things, and has been built using a variety of materials such as natural stones, trimmed bricks, small pebbles, sea shells and coloured glass bottles.

10. **Ensure public safety**: A smart city should be able to offer safety to all its citizens. To achieve this goal, families must sensitise and educate their children on matters of safety and security. The State should also sensitise and reform functioning of governing bodies, the police force and the judicial machinery for the enforcement of law. Other measures include more surveillance and monitoring by the administration, ensuring good lighting and visibility in public spaces, technology driven interventions, and reducing the gap between the lifestyles of the upper, middle and lower classes by creating an affordable housing stock and providing sanitation facilities to the poor. Furthermore, at places (e.g., South Africa) where the history of racism has not been resolved and there is a long legacy of gender-based violence, the policies and action plans must address such core issues.

11. **Facilitate travel for disadvantaged groups**: Workers living in peripheral areas but working in central parts of cities can benefit from the implementation of rational public transport policies. The policy should ensure that low-income workers engaged in formal employment

do not spend more than a fixed proportion (e.g., six percent) of their basic salary on public transport. The additional amount spent by the workers should be borne by the employer. Such a policy (namely *Vale-Transporte*) has been implemented in Brazil where employers are seeing a higher level of attendance, and there is a rise in demand for public transport services. Similarly, mobility planning for the elderly must be done based on their movements. In Shanghai, data on places most frequently visited (such as grocery stores and parks) were collected through surveys conducted over a period of eight years. Such data help in the formulation of effective plans. In the city's urban planning bureau, a collection centre has been created that provides inputs for designing new development projects.

12. **Increase ICT penetration**: By providing online and mobile-based citizen services and installing video surveillance systems, numerous benefits can be derived. For example, systems set up for registering complaints pertaining to housing and public utilities can help government agencies to quickly resolve the problems based on inputs and photos received from citizens. Also, an e-referendum system can allow the city government to submit vital issues for the consideration of citizens. Similarly, surveillance systems can help in identifying and solving crimes. Widespread use of ICT platforms (such as Our City and Active Citizen) in Moscow has resulted in time and budget savings for the city government.

13. **Use digital technologies judiciously**: There is tremendous scope for digital technologies to be an integral part of modern life. For example, cashless technologies allow a 'one-touch' payment for obtaining various kinds of services. This liquidity can be used within various business models of companies working in the realm of digital financial technologies, such as crowd funding, P2P lending, micro-savings and micro-insurance. The SKOLKOVO Institute for Emerging Market Studies in Russia attempts to introduce a quantitative measurement of the depth of penetration of digital technologies in various sectors, such as transportation, finance, retail trade, healthcare, education, media and administration. China aims to simplify the processes involved in delivering government services to the citizens by laying down a comprehensive ICT architecture, building a national citizen database and creating a single window to meet citizen needs in an easy and friendly manner.

14. **Systematise spatial data and interactions among stakeholders**: A tool (namely Agent-based Modelling) is available for use which can help in systematising the bundle of available spatial data and interactions among multiple actors, and anticipate outcome of a proposed policy before it is implemented. In this method, a computational simulation runs a model in which the actions and interactions among citizens, firms, institutions and governments are analysed (for example, to investigate collection of taxes and redistribution of public services across municipalities). Using the tool, it is possible to acquire a better understanding of the actual conditions prevailing in cities and, thus, formulate effective policy solutions. Researchers at IPEA in Brazil are refining and using such a model.

15. **Create online data platforms**: Online platforms containing up-to-date data and information on numerous human development indicators such as demography and health,

education, income, labour, housing, and vulnerability can help in understanding and effectively responding to the urban inequalities. One such platform (namely the Atlas of Human Development in Brazil) has been created jointly by UNDP, IPEA and FJP in Brazil, which provides data for municipalities, states and metropolitan areas, and where citizens also get the opportunity to participate in building guidelines for the cities' future.

16. **Facilitate citizen engagement with government through social media platforms**: The use of internet-based social media tools and platforms (such as smartphones, and Twitter and Facebook) is increasing. Citizens often discuss governance issues using these modes. Such modes can be customised to advance meaningful citizen engagement with government. This would help in maintaining an informed decision-making process for policymaking, planning and implementing infrastructure projects. To facilitate regular interactions between government officials and citizens, and to obtain feedback, city governments should ensure an increase in smartphone ownership and provision of affordable and faster internet and free wi-fi services. India's Prime Minister, for example, took questions directly from the public using MyGov platform, created for generating citizen feedback on issues, such as what should be included in the rail budget, and the new education policy. In the south Indian city of Vijayawada, about 300 camps were set up in educational institutions to invite ideas from students. The city of Jaipur is running a contest for the citizens on MyGov platform to redesign a park and a traffic junction. Further, the internet and social media can be used by citizens living in low-income areas to report misconduct and brutality by the administration (such as by the police) and to map violence. The internet activism in *favelas* and low-income neighbourhoods of Rio de Janeiro started with the local population obtaining internet connection and smart phones. This has helped in the propagation of reports and producing evidence of serious human rights violations. Indeed, smartphones can be used as a tool of social control over abuse.

17. **Use GIS and rational guidelines for provision of social facilities**: Instead of doing conventional planning for new facility locations based on planning units (i.e., blocks or suburbs), planning can be done on the ability to reach a facility within a desired distance. In this approach, the supply and demand are matched within a spatial context based on access parameters (such as distance or time) in conjunction with provision norms (such as population threshold per facility). This method can help to inform GIS-based planning for capital budget processes and thus maximise return on investment. The Council for Scientific and Industrial Research (CSIR) in South Africa has consolidated, refined and adjusted guidelines for the provision of social facilities in settlements to achieve equity in facility provision.

18. **Map built-up structures and infrastructure networks**: Mapping buildings and infrastructure in cities can help in the restructuring process. A complete listing of all built-up structures will ensure improved collection of property tax. Similarly, maps showing infrastructure networks (water, sewer lines, electricity cables) situated both above and below the ground will be helpful at the time of undertaking any excavation and tunnelling work.

2

China Smart City Pilot and Financing

– JIJUN CHEN –

Introduction

Smart cities are an important part of China's 'new-type' urbanisation. Since 2012, China has announced three phases of smart city pilot projects. Around 500 cities in China are involved in the national smart city pilot programme. It is estimated that in the next few years, China will invest more than ¥1 trillion in smart city implementation. In the pilot, transportation, medical services, government services and other kinds of civic support have been made available through apps; these have achieved a wide range of practical results. Different approaches have been used to raise the funds needed to build these smart cities. The experience of smart city financing in China will help in similar future projects for BRICS countries.

China's 'New-Type' Urbanisation

The process of large-scale urbanisation in China is a major event which will affect global development trends in the 21st century.

Before China started its reforms in the late 1970s, the country was overwhelmingly rural, with more than 80 percent of the population living in the countryside. By the end of 2011, half of China's population was living in cities. Another 500 million people have been added to China's urban population in the last three years. In 2014, China unveiled an urbanisation plan for the period 2014–2020. By 2020, permanent urban residents will comprise about 60 percent of the population. China has vowed to help around 100 million migrant workers and other urban residents obtain urban homes. By 2030, China's cities will be home to roughly one billion people—three times the current population of the United States (US).

As China undergoes a rapid process of urbanisation, its cities are becoming bigger. Today, China has 142 cities, most of them with a population of 1 million or above, six of them having a population of 10 million or above. China also has another 10 cities with a population between five to 10 million. Some of these megacities are struggling to meet the needs of their growing population. There needs to be effective regulation to address this problem. China needs to intensify the integration of its transportation and information networks, for example, and promote green,

low-carbon development, the proper distribution of key industries and public resources, to move some of the megacities' economic capacity and other functions to other areas, and help small and medium-size towns to develop industries and attract residents.

The Chinese Cabinet, the State Council, released the National New-Type Urbanisation Plan (2014–20) on 16 March 2014, indicating that China's 'new-type' urbanisation had been officially launched. This plan will greatly influence China's urbanisation process in the coming years.

Different from the traditional urbanisation mode, which simply displaced people from rural to urban areas and caused urban diseases such as traffic jams; inadequate capacity to deal with sewage and garbage; and pollution of air, water and soil, the new-type urbanisation highlights ecological preservation and focuses on the quality of urbanisation. The transformation of 'traditional urbanisation' to 'new-type' urbanisation will enable China to steer its urbanisation along a human-centred and environment-friendly path.

The following are the key points of China's new-type urbanisation:

- Improving macroeconomic control to promote sustainable and healthy development. Urbanisation will boost domestic consumer spending, which is the foundation for growth, by creating a number of hotspots for consumption, and will allow investments to play a key role. Urbanisation will increase and guide private investment and expand public spending on infrastructure projects.
- Maintaining a proactive fiscal policy and prudent monetary policy. Fiscal policies will focus on tax reforms and structural tax reduction, as well as stricter control of administrative fiscal spending. Prudent monetary policy needs more flexibility. Property controls will be unchanged.
- Boosting agricultural development and ensuring sustained supply of agricultural products to the cities.
- Speeding up industrial structural adjustments and lifting the quality of production in industrial sectors. The focus is on reduction of excess capacity, and enhancement of enterprises' innovation capability.
- Actively and steadily promoting urbanisation and improving its quality. The plan emphasises quality development of urban areas. Urbanisation will release the full potential of domestic demand.
- Improving people's livelihood security and lifting their living standards.
- Deepening economic reforms in a holistic way. It will subsequently announce reform plans, roadmaps and timetables.

"If managed well, urbanisation can create enormous opportunities, allowing innovation and new ideas to emerge, saving energy, land and natural resources, managing climate and the risk of disasters," noted Mulyani Indrawati, Managing Director and COO of the World Bank, at a conference in Beijing.

Smart City as a Big Effort for China's New-type Urbanisation

First proposed by IBM, the 'smart cities' concept promotes the use of new technologies such as the Internet of Things (IoT), which allow users to control and manipulate objects through computers and cloud computing to boost information sharing and coordination within a city. The 'smart city' concept is expected to generate changes in various fields, ranging from transportation to finance. With the help of data analysis, for example, big cities will be able to calculate the extent of traffic and make rational transportation routes to ease any gridlock.

A smart city is an urban development vision that integrates multiple information and communication technology (ICT) and IoT solutions in a secure fashion to manage a city's assets, which include, but are not limited to, local departments' information systems, schools, libraries, transportation systems, hospitals, power plants, water supply, waste management, law enforcement and other community services. The goal of building a smart city is to improve quality of life by using technology to raise the efficiency of services and meet residents' needs. ICT allows city officials to interact directly with the community and keep a close watch on the city's infrastructure, monitor what is happening in the city, how the city is evolving, and find ways to enable a better quality of life. Through the use of sensors integrated with real-time monitoring systems, data are collected from citizens and devices, then processed and analysed. The information and knowledge gathered are keys to tackling inefficiency.[1]

"Intensive, intelligent, green and low carbon" are four major characteristics of the new-type urbanisation in China. The concept of 'smart city' matches the principles specified by China's National New-type Urbanisation Plan, and it is believed that the smart city concept presents a beautiful picture of both the country's future urban life and potential for economic growth. "The construction of smart cities will facilitate the transformation of China's urban industries, innovate social management, improve the ecological environment and promote the public services system," said Guo Liqiao, Deputy Director of the Department of Science and Technology at the Ministry of Housing and Urban-Rural Development (MOHURD).

The national 12th Five-Year Plan, which guided broad economic policy through 2015, specifically called smart city technology an area to be strengthened and encouraged. Ministries are jostling to sponsor programmes and industry alliances. In 2012, the Ministry of Science and Technology (MOST) organised the China Strategic Alliance of Smart City Industrial Technology Innovation. In 2013, the Ministry of Industry and Information Technology (MIIT) sponsored another group, the China Smart City Industry Alliance, and in 2014, announced a ¥50 billion ($8 billion) fund for investment in smart city research and projects. In the spring of 2014, the China Smart City Development Alliance was formed by the National Development and Reform Commission (NDRC). In addition to these, there is a total of 41 smart city related alliances in China supported by Chinese and foreign governments, associations and organisations. These alliances have greatly promoted the development process of China's smart cities.

2014 was the first year of China's smart city construction. A smart city built using a new generation of ICT technologies such as networking, Internet, cloud computing, big data, remote sensing, and other cutting-edge technologies, will not only improve efficiency of research, development, production, management and services, but also break the limitations of time and space, and achieve the organic integration of economic development and social living. It can

thus make the city's public service resources more accessible, make urban management more scientific, living environment more beautiful, industrial structure more efficient and urban and rural development more balanced. Ultimately, it will improve the quality of urbanisation.

China's Smart City Pilot Projects

China's smart city pilot projects are led by MOHURD. On 5 December 2012, MOHURD released a work notice to carry out the national smart city pilot.

So far, MOHURD has carried out three phases of the national smart city pilot. Table 1 gives the details of the 289 cities involved in the three phases' pilot. At present, more than 95 percent of China's deputy provincial cities, 76 percent of cities at the prefectural level and above — a total of more than 230 cities — are turning 'smart.' More than 80 percent of China's cities have strategically chosen to implement the smart city programme in their 12th Five-Year Plans to accelerate economic development.

Table 1: Statistics of Cities involved in Three Phases' Pilot

Pilot City / Administrative Level	Phase I	Phase II	Phase III	Total
Provincial Capital	5	5		10
City	30	36	37	103
County	18	30	33	81
City Zone	34	27	24	85
Town & Village	3	5	2	10
Total	**90**	**103**	**96**	**289**

Source: Ministry of Housing and Urban-Rural Development (MOHURD, 2012).

The mission of the national smart city pilot is to promote intensive, smart, green, low-carbon development, to stimulate domestic demand, and promote industrial transformation and upgrade. It requires all participating cities to take smart city implementation as an opportunity; actively carry out institutional innovation; explore proper urbanisation modes; strengthen urban planning, construction and management; and enhance the fusion of industrialisation, urbanisation and information.

Currently, China's smart city implementation is concentrated on solving urban problems caused by rapid urbanisation, improving the quality of life of residents, and enhancing urban sustainable development. There are different types of smart city projects. Each type of smart city project is designed to address a specific urban problem. For example, smart transportation is targeted to systematically solve the city's transportation problem, including parking,

Figure 1: Top 15 Types of Smart City Projects by Quantity
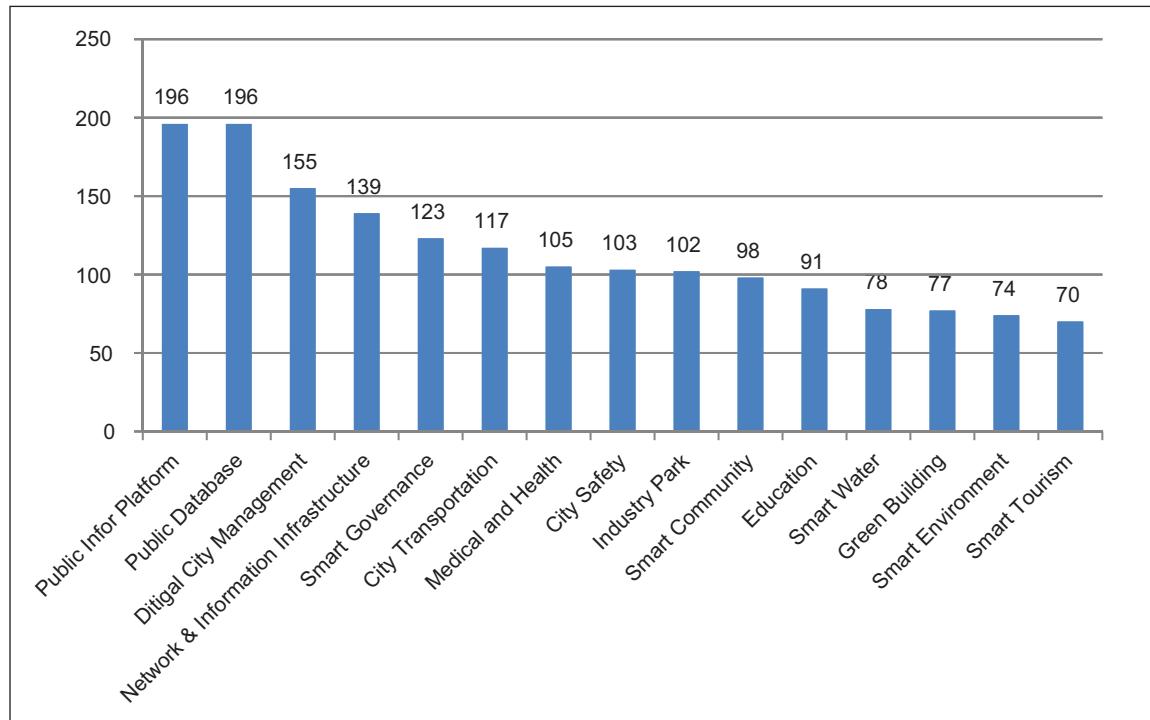
Source: Ministry of Housing and Urban-Rural Development (MOHURD, 2012).

transportation governance, real-time traffic monitoring and control, traffic guidance, and real-time information searching. Each smart city pilot is precisely planned to solve the piloted city's problem and enhance the city's capability of continuous development by implementing specific types of smart city project combinations.

Based on the analysis of 289 cities in MOHURD's smart city pilot programme, the top 10 types of the smart city projects are public information platforms, public databases, digital city management, network and information infrastructure, smart governance, city transportation, medicine and health, city safety, industry park management, and creating a 'smart' community (Figure 1).

With more and more attention being paid to the smart city, smart city standard development work is also accelerating. In 2013, the Electronic Standardisation Research Institute of the MOHURD standards committee, the Telecommunications Research Institute and other departments accelerated the deployment of smart city standard system construction, publishing the relevant standards or reports. In November 2014, the International Organisation for Standardisation's group on ICT standards (ISO/IECJTC1) in the Third Plenary Session of its 11th Central Committee formally adopted the establishment of the "Smart City Research Group," proposed by China. Relevant personnel from China's Electronic Industry Institute of Standardisation and its Ministry of Industry and Information were appointed group chairman and secretary, while the US, France, South Korea, Japan, Canada, the Netherlands, Germany, Britain and Singapore have said they will actively participate in the research group.

By the end of 2014, NDRC, MIIT, MOHURD and 25 other ministries had established a smart city inter-ministerial coordination mechanism and a working group to coordinate and solve major cross-sector, cross-domain problems during the smart city construction process, and promote healthy development of smart cities in China. The working group has carried out studies on the integration of smart city with national strategies, such as the 'One Belt, One Road' initiative, the Beijing-Tianjin-Hebei integration, the Yangtze River Economic Belt development, and striven to promote smart city standardisation.

Smart City Financing in China

In China's smart city pilot programme, each smart city project is reviewed by teams of information technology experts, financial experts and government officers. Each has a clear goal to solve specific city problems, and represents an opportunity to enhance the city's performance and accountability.

Smart city financing is essential to the success of each project. Using modern administrative and management techniques, including developing capabilities to access finance from multiple sources and a mindset conducive to achieving outcomes, are also integral to building a successful 'smart city.' It is clear that budgeted funds alone will not be sufficient to fully finance the development of smart cities. Indeed, other modes of financing such as Public Private Partnerships (PPPs), bonds, bank loans and other sources of investment need to be explored to generate enough funds for smart city projects and to diversify risks.

Since MOHURD officially launched smart city pilot projects in China, a total of 289 cities have been selected as smart city pilot project sites (90 cities in Phase I, 103 cities in Phase II and

Figure 2: Top 15 Types of Smart City Projects by Investment
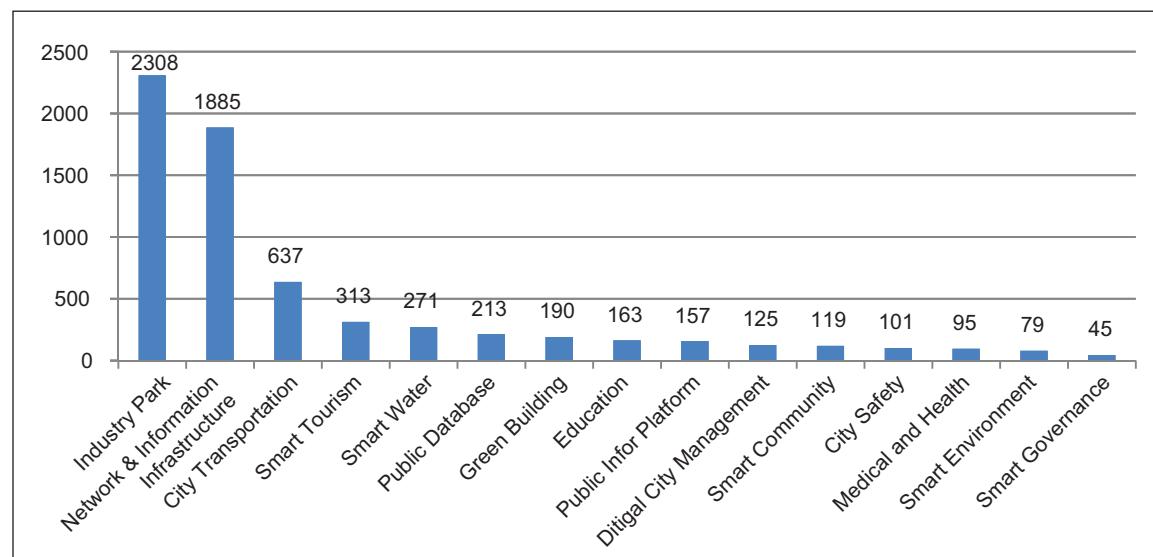
Source: Ministry of Housing and Urban-Rural Development (MOHURD, 2012).

96 cities in Phase III), making them eligible for funding from a ¥100 billion (about $16 billion) investment fund sponsored by the state-owned China Development Bank (CDB). Industry park, network and information infrastructure, city transportation, smart tourism, smart water, public database, green building, education, public information platform, digital city management, smart community are among the top 10 types of smart city projects in investment (Figure 2).

Investment from local government and private sources has also been growing fast. There's no standard definition of the sector, but some experts foresee ¥2 trillion (about $320 billion) of investment in smart city development projects over the next 10 years. No matter whether it is defined broadly or narrowly, the investment will be huge.

Smart city financing in China needs to be viewed with a complete, balanced, feasible investment financing plan and an effective, risk controlled financing system. The new investment model needs to be market driven, guided by the government with major social participation.

Smart city financing in China will be of four main kinds: government funds, bank loans, the enterprise's own funds and funds from other sources. The smart city pilot involves a total of nearly 2,600 key projects. In all investments, government funds will comprise 25 percent, bank loans 20 percent, enterprise funds 33 percent, with the rest coming from a variety of other sources.

Currently, smart city information infrastructure construction—such as networking, cloud computing centres, disaster recovery centres and information terminal construction—are mainly financed by government funds, supplemented by enterprise and social investment. Smart city application systems, such as city transportation, medical services, power grid, urban management, and home, environmental protection, are financed mostly by the participating enterprises. 'Build-Operate-Transfer' will be the operating model for medical, public-service platform and relative smart city applications. Since the investment needed for smart cities is huge, many provincial governments are still in discussions over which construction and operational modes will be the best. This can ultimately form a continuous and healthy pattern for smart cities in China.

Further work on smart city financing will include establishing a market-oriented operational mechanism, nurturing full participation of enterprises and social capital, and establishing a smart city credit rating system.

China's government also seeks to strengthen cooperation with foreign industrial institutions and financial capital from South Korea, Japan, France, Germany, Italy, Sweden, Finland, Singapore and the European Monetary Cooperation Fund.

End Note

Smart city in China is an effort for China's new-type Urbanisation to solve the urbanisation problem smartly, which is similar to other BRICS countries during their urbanisation period. China's experience in smart city financing, started by government-granted loan and accelerated by social capital through the PPP model, would be beneficial to all BRICS countries. BRICS countries could enact an effective mechanism and take active steps for practical cooperation in smart city strategy, framework, technology innovation, implementation and financing.

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3

Urban Development in Brazil and the Challenge of Building Smart Cities

– ANA PAULA BRUNO –

Introduction

Since 2000, Brazil has been through a great normative and programmatic progress in the urban and housing fields. This progress is rooted in the country's democratisation process, which culminated with the enactment of the Federal Constitution in 1988. This was followed by the approval of the Statute of the City in 2001, a general urban policy norm (National Law n 10.257/2001), the creation of the Ministry of Cities in 2003 and, subsequently, the implementation of its structure for participation and social control, the Council of Cities, in 2004.

By gathering several urban themes, till then found scattered in the federal government structure, the creation of the Ministry of Cities sought to give an institutional answer to Brazil's severe urban problems. In the last 13 years since the creation of the Ministry, policies, programmes and actions have been formulated in the themes of urban mobility, transportation, traffic, environmental sanitation, housing, land tenure regularisation, risk prevention, and accessibility for the disabled.

These policies, programmes and actions were aimed in some cases at non-profit civil organisations, but mostly, at the states and municipalities as well. This entire process was followed by a significant increase in federal investments in the cities.

In 2007, the creation of the Growth Acceleration Programme (PAC), which directed resources to several lines of action in the Ministry of Cities, and the creation of the federal housing programme called 'Minha Casa, Minha Vida,' in 2009, made large-scale interventions in Brazil's cities possible, and at the same time highlighted existing challenges that must be overcome at the local level.

This article presents an overview of the urban policy in Brazil, and discusses the perspectives to incorporate the emerging theme of Smart Cities in the Brazilian context. It also points to some important measures to overcome these challenges, and they are linked to the theme of smart cities.

Brazil's Urbanisation: A Profile

Brazil had achieved high levels of urbanisation by the early 1970s, with 56 percent of its inhabitants living in cities. Its urbanisation process took place, more intensely, in the second half of the 20th century; between 1950 and 2000, about 119 million inhabitants were incorporated into urban areas, with the highest peak taking place between 1960 and 1980. The urban population continued increasing thereafter, albeit at a lower rate. By 2010, 160 million Brazilians were living in cities, representing 84 percent of the country's total population.[1]

Brazil's urbanisation process was, and continues to be, characterised by deep imbalances. From a regional perspective, the urbanisation was concentrated in some parts of the country, notably in the coastal and the southeast regions. São Paulo and Rio de Janeiro, Brazil's two major cities that hold nationwide influence, are in these regions.

Today, Brazil has 5,570 municipalities, with highly distinct characteristics between them. Moreover, they are in regions with unique characteristics, shaped by environmental, economic, social and cultural conditions, which influence the differences among these municipalities.

Data from the 2010 Census show that 70 percent of Brazil's municipalities have up to 20,000 inhabitants, 25 percent have between 20,000 to 100,000 inhabitants, and only five percent, or 283 municipalities, have over 100,000 inhabitants. However, the last group is home to 54.7 percent of Brazil's population (104 million people), the intermediate group to 28.1 percent (53.6 million), and the first group, comprising smaller cities, is home to 17.1 percent (32 million).

From Table 1, it is possible to infer that the urban homes are predominately in bigger cities, which clearly shows the concentrated nature of Brazil's urbanisation mentioned earlier.

Table 1: Profile of Brazil's Municipalities by Population Size (Inhabitants)

Class and Size of the Municipalities according to Population Size (Inhabitants)	Residing Population				Number of Cities	
	Total	(%)	Domicile Status (%)		Total	(%)
			Urban	Rural		
Brazil	**190,755,799**	**100**	**84**	**16**	**5,560**	**100**
Upto 5,000	4,374,345	2	56	44	1,301	23
From 5,001 to 10,000	8,541,935	4	60	40	1,212	22
From 10,001 to 20,000	19,743,967	10	61	39	1,401	25
From 20,001 to 50,000	31,344,671	16	70	30	1,043	19
From 50,001 to 100,000	22,314,204	12	81	19	325	6
From 100,001 to 500,000	48,565,171	25	94	6	245	4
Over 500,000	55,871,506	29	99	1	38	1

Source: Brazilian Institute of Geography and Statistics (IBGE), BRASIL/IBGE, Census 2010.

This urbanisation process did not happen under a consistent State urban and housing policy; indeed, it was the public policy of "no action," as mentioned by Ferreira (2009).[2]

In this respect, a large proportion of urban areas in Brazil were formed through "state intervention by its absence," or the "self-enterprise" in the provision of housing, which resulted in precarious settlements, as mentioned by Bonduki (1994).[3] These settlements are characterised by irregular land tenure, absence or precarious infrastructure, and occupation of hazardous or environmentally protected areas.

On an intra-urban level, the distribution of the population is characterised by a deep imbalance; with differentiated shapes and locations, the socio-territorial inequality is a regular pattern in Brazil's cities. There is no equitable access to housing, urban equipment and services, such as daycare centres, sewage and clean drinking water, and good quality public transport.

The Action of the Ministry of Cities

Brazil's urban policy has undergone changes since the Federal Constitution passed in 1988, which marked a new period in the policy's national legal framework. Since then, the municipalities have become the federal public bodies responsible for planning, implementing and managing the urban policy.

The constitutional text established that the city and the property must comply with social functions, to balance private interests with that of the community, according to definitions embodied in the Master Plan, mandatory in cities with over 20,000 inhabitants. The Master Plan is the essential element for municipal planning and contains strategies for urban development at a municipal level. It must be developed with social participation and convey the strategies of territorial development, establish the zoning, including special areas of social interest for the construction of social housing and the consolidation of irregular settlements, tools for land management, indices and urban parameters.

According to the Federal Constitution, the role of the National Level State is to legislate over urban policy in general terms. Moreover, while the municipalities have political, administrative, budgetary and financial autonomy, the Federal Government supports them in fulfilling their duties of planning, implementing and managing policies in their territories. It is important to note that, despite this financial autonomy, revenue collected in most municipalities is not sufficient for further investments. This makes the municipalities severely dependent on the transfer of resources from other federal bodies, especially from the Union government.

The milestone of Brazil's national urban policy is the Statute of the City (Law 10.257/2001), which as the first general guideline states, is "the assurance to sustainable cities, construed as the right to urban land, housing, transport and public services, work and leisure, for the present and future generations." All these rights, addressed together, are called "right to the city."

The Ministry of Cities was created in 2003 with the institutional task to support the implementation of the "right to the city" by all stakeholders. Over the past 13 years, the National Policy of Mobility and Urban Transport (National Law n 12.587/2012), the National Policy of Housing (National Law n 11.124/2005 and National Law n 11.977/2009), the National Policy of Urban Landholding Regularisation (National Law n 11.977/2009) and the National Policy of

Basic Sanitation (National Law n 11.445/2007) have been created at the Ministry of Cities. These issues focus on the main priority areas related to Brazil's urban problems.

Besides these, other policies were formulated in the Federal Government to address urban problems, involving other bodies at the national level, with the participation of the Ministry of Cities. This included the National Policy of Solid Waste (National Law n 12.305/2010), under the jurisdiction of the Ministry of Environment, the National Policy of Protection and Civil Defense (National Law n 12.608/ 2012), and the topic of Inclusion of People with Disabilities (National Law n 13.146/2015), both inter-ministerial.

Those policies under the jurisdiction of the Ministry of Cities were organised into five common axes, without disregarding the specificities of each topic: the edition of national regulatory frameworks (1), the incentive for planning at the local level (2), the participation and social control (3), the improvement of the capacities of local agents (4), and the transfer of federal resources to launch local investments (5).

The edition of regulatory frameworks at a national level (1) (enactment of laws, decrees and other kind of regulations) sought to establish the principles and guidelines for each of the policies, to organise the jurisdiction and the stakeholders engagement (particularly the federal bodies involved with its execution), to resolve conflicts, and to make available legal instruments for their implementation. It also attempted to formulate investment programmes with resources from the central government.

The incentive for planning at the local level (2), in turn, was applicable to all the stakeholders, especially the government agents of the municipalities. They sought to apply the agents to recognise, systematise and prioritise the municipalities' needs in such a way that the federal policies would be well implemented at local levels. By legal or programmatic command, or as a recommendation, in many cases with the transfer of federal resources, all the policies embraced the local plan.

The planning instruments established for the local levels as part of the National Policies included the Social Housing Local Plan, the Basic Sanitation Local Plan, the Urban Mobility Local Plan and the Accessible Routes Local Plan (for the municipalities obligated to elaborate a Master Plan), the Land Tenure Regularisation Local Plan, and the Disaster Risk Reduction Local Plan.

By legal ordinance, municipalities with over 20,000 inhabitants and others with territorial characteristics specified by law were obligated to elaborate a Master Plan by the end of 2007. The Master Plan, formulated through a participatory process, should be able to articulate the sectorial policies in the municipal area, with a territorial approach. To support its elaboration by the municipalities, the Ministry of Cities, together with the Council of Cities, undertook a National Campaign called 'Participative Master Plan: A City for All,' in 2005. It has had an impact on a number of plans that had been formulated.

In 2015, through the approval of the Statute of the Metropolis (National Law n 13.089/2015), the Integrated Urban Development Plan was added to this set of plans, which should be finalised by the beginning of 2018. This is likely to be done through a participatory process and treated as an inter-federal matter by the states and municipalities, which are part of each of Brazil's metropolitan regions. It is a territorial plan that faces urban planning challenges, which reaches beyond the political and administrative limits of one single municipality, focused on public functions with the common interests previously defined.

The participation and social control (3), on its part, were internalised in each of the public policies as an expression of "democratic management of the cities," one of the milestones of the Statute of the Cities. Many of the public policies predicted, in their regulatory frameworks, the structuring of thematic councils, at the three government levels: municipalities, states and federal. In the urban policy, understood in general as the consolidation of all the urban sectorial policies, with the macro component of territorial planning co-substantiated in the Master Plan, the structuring of the cycles of Cities Conferences is highlighted.

The cycles of Cities Conferences, organised in a "top-down-top" strategy, begin with the proposition of a theme by the Council of the Cities (at National Level), composed of members of public authority and representatives from several segments of civil society, which are then discussed at the State and Municipal Conferences, and finally at the National Conference of the Cities.

At each of these gatherings, delegates are elected. Finally, at the National Conference, the members of the Council of the Cities are defined. There are 86 available seats, distributed throughout the segments. The first conference began in 2003 and five conferences in total have been held since then. In each of the conferences, a letter is produced with the agenda for the next period, pressing the Executive to correct its policies, programmes and actions.

The improvement of the capacities of local agents (4) aims to support the implementation at local levels of these national policies, combining actions of disclosure, awareness, information and training. The idea is to reduce the identified technical and institutional gaps of the ones responsible for the elaboration and implementation of the plans, programmes and actions, as well as the ones committed in the process of social participation and control.

Besides the poor technical and institutional capacities, especially of Brazil's municipalities, the policy reconfigurations, the addition of new normative landmarks and the creation of new programmes demanded a strategy of constant development of administrators, technicians and members of the civil society. This ultimately resulted in the creation of the National Programme of City Qualification, nowadays supported by a platform of distance learning called 'Capacidades.'

The transfer of federal resources (budget) to the municipalities (5) was meant to provide direct support to competent agents for the implementation of services, projects and works, which were selected through a public process as per policy guidelines, in consonance with specific criteria related to the existing demands in each thematic area. This allowed the municipalities to address the low capacity of investments.

In most cases, the agents that received resources belonged to federal bodies, mainly municipalities. The exception to this were policies that required the direct involvement of the states, such as the Policy of Urban Basic Sanitation, or those cases where the states were better equipped than the municipalities to respond to the problem. Some programmes also allowed for the transfer of resources to non-profit civil society organisations.

Overall, the transfer of federal resources was possible through signed contracts between the Union and the beneficiary agents of the transfers. This also required the participation of federal state banks, especially CaixaEconômica Federal, which served as a legal representative of the Union to oversee the signings of the contracts and the development of the services, projects and works.

This form of operations was adopted because of the reach of these financial institutions, capable of adequately adjusting to the country's size and diversity. The transfers occurred through grant

assistance, like the case of Brazil's Federal Budget, OGU, or using long-term costly compensation resources, like with the Employee Government Severance Fund, FGTS (compulsory savings of formal Brazilian workers), and with the Brazilian Development Bank, BNDES.

Since 2007, with the adoption of a national strategy to realise greater investments in infrastructure, embodied in the Growth Acceleration Programme (PAC), the sectoral policies for urban areas have raised a large amount of resources. In the "Social Urban Hub" of PAC, measures were included in the areas of housing, urban mobility, sanitation and risk prevention, under the supervision of the Ministry of Cities. Other issues such as management of water resources, provision of social equipment, qualification of historical cities and the "Luz Para Todos" programme — this one meant for rural areas — were under the overall supervision of other ministries.

In 2009, with the creation of the federal programme "Minha Casa, Minha Vida," the issue of housing gained prominence, with a significant increase in investments, which helped promote the productive sector, the main agent of the programme, and which in turn led to an increase in the number of jobs and income in Brazil for some years. The investments in the housing area were made in partnership with states, municipalities, urban and rural non-profit civil organisations, and the private productive sector. In this field of housing, two axes were structured: the construction of new housing units by the "Minha Casa, Minha Vida" Programme and the upgrading of the informal settlements.

The upgrade of the informal settlements was a kind of intervention that addressed the various issues related to the precariousness of these occupations: social improvement, provision of new housing, building of new or complementary infrastructure, as well as environment issues, and the legal regularisation of ownership of the houses (the dimension of the landholding regularisation).

The investments in the mobility area prioritised public transportation, through the execution of projects that promote physical and tariff integration in the public transportation, as well as foster large and medium-scale projects. Investments in the sanitation area included actions designed to improve access to water supplies, sewage treatment, and the collection and disposal of solid waste. Investments in risk prevention included drainage works and containment of flood and risk areas.

Finally, among the investments in social equipment, the Digital Cities Programme should be highlighted. Under the supervision of the then Ministry of Communications, it was oriented to provide municipalities of up to 50,000 inhabitants with technological infrastructure to improve the management and the provision of public services. The official document says:

> "The actions defined in the programme involve the installation of optic fiber connecting local public agencies, to make available electronic government applications for city halls in the areas of finance, tax law, health and education, the training of public officials for its use and web management, the opening of positions to train the population in the TIC area (Information and communication Technologies) [....] and the installation of public points for the access to free internet."[4]

Besides these, many other policies and programmes for urban planning were financed. This included allocation of resources for management of water resources, and for building daycare

centres, basic healthcare units, prompt service units, child education centres, and unified arts and sports centres. The 'Cidades Históricas' (Heritage Cities) Programme was also an important initiative that sought to integrate the interventions for the restoration of historical areas and the preservation of Brazil's heritage.

Reflection at the Local Level: What is needed to build Smart Cities?

Despite much progress, Brazil's cities cannot be considered as examples of good urbanisation. The challenges persist and it is difficult to achieve the "right to sustainable cities" as established in the Statute of the Cities.

According to the preparatory document for the UN Conference on Housing and Sustainable Urban Development, Habitat III, *Issue Paper Smart Cities*, "Many definitions of 'smart city' exist, and 'smart' approaches have been understood differently by different people and sectors."[5] In the same document, two important concepts are presented:

> Smart City Planning and Design: An approach leveraging new knowledge and tools to promote urban planning and design that address evolving needs and challenges of urbanisation.
> "Smart"/"e"-approaches: Often used to refer to efforts that are innovative and/or utilise technology, particularly information and communications technologies (ICTs) to enhance the efficiencies of urban systems, increase the quality and effective delivery of services, empower citizens, address environmental challenges and disaster risks (e.g., smart grids, smart transport, smart energy, e-participation, e-services, e-government, etc.).[6]

Of these concepts, two basic elements can be identified in the conceptualisation of a 'smart city': one is innovation and another is technology, particularly "Information and Communications Technologies" (ICTs). These elements must be oriented to solve present and future urban problems, to improve the provision of services and, consequently, the quality of life of the population. In a smart city, another consensus is that the citizens should be empowered to make opinions about the city and claim ownership over it.

It remains to be seen how the concept of smart cities can be applied to the Brazilian context or to the cities of any developing countries, where essential needs are yet to be met. The 'smart city' cannot be considered as a new issue (or a new agenda) but presents a new approach based on using innovation and technology to help solve old problems: social-territorial inequality, the poor quality of public services, the precariousness of data and information, the bottlenecks in social participation, the low institutional capacity of the municipalities, and the persistent challenges in the planning and management process, especially at local levels.

Official data[7] show that between 2005 and 2015, there was a significant increase in the number of municipalities with a well-defined and elaborate Master Plan, mainly among those with over 20,000 inhabitants, mandatory by the constitutional text (Chart 1).

The data show that in 2015 "95.0 percent (5,290) of the municipalities had at least one of the planning instruments that were researched. In all the classes of population size, the

Chart 1: The Percentile of the Municipalities, Total, with up to 20,000 inhabitants and with over 20,000 thousand inhabitants (according to the status in the Master Plan), Brazil 2005/2015
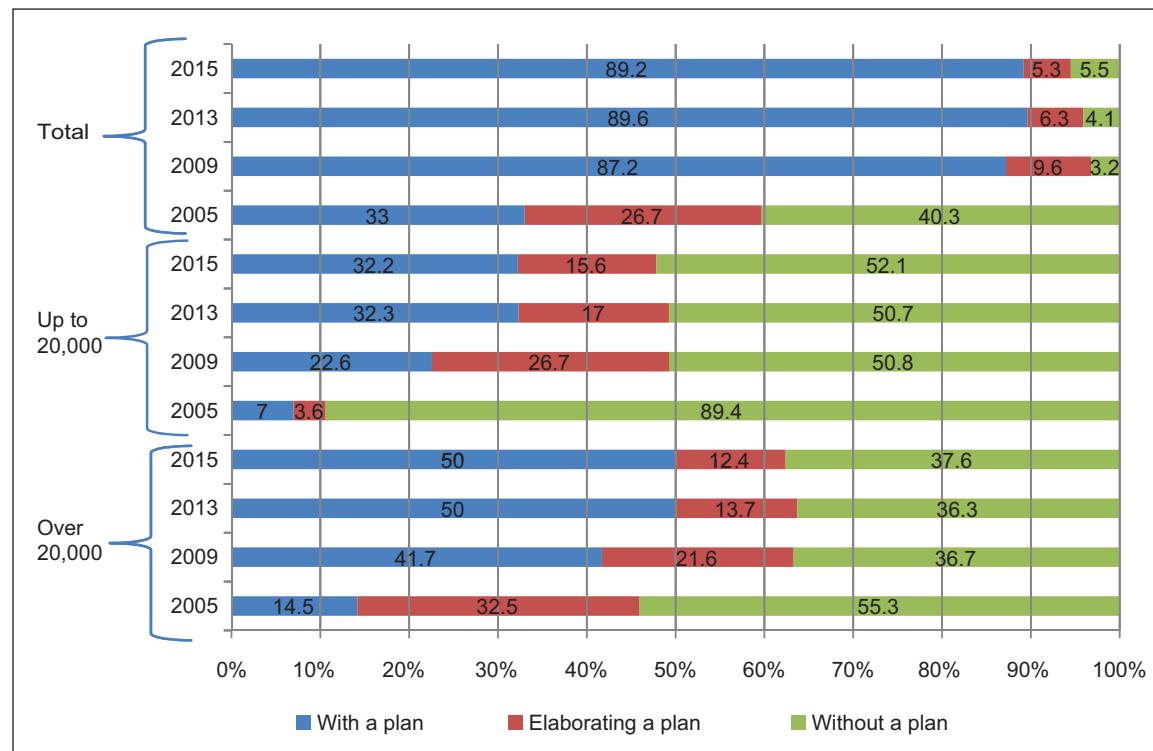
Source: Brazilian Institute of Geography and Statistics (IBGE). BRASIL/IBGE, 2016: 18.

percentages were over 90.0 percent, reaching 100 percent in the municipalities with over 100,000 inhabitants."[8]

However, in spite of these quantitative advances, a research conducted between 2007 and 2010, which analysed over 500 Master Plans in Brazil, highlighted an important qualitative problem in these plans:

> "One of the main problems identified [....] is that several guidelines and instruments are not suitably delimited in the territory. [.....]. Few were the plans that moved forward in the suitable territorial guidelines and instruments, which evidences, in several cases, the displacement of purposes in the plan with the municipal territory and the fragility of the urban development strategies intended in these Master Plans."[9]

In other words, this means that sectorial policies do not find suitable territorial expression in the urban policy, and that the urban development, which is not sectorial in principle, lacks a consistent territorial strategy. This is a reflection of the lack of integration of policies in the territory, most evident in metropolitan areas.

Chart 2: Percentage of Municipalities with a Geographic System of Information and Digitalised Cartographic Base (according to size classes of the population of the municipalities), Brazil 2015
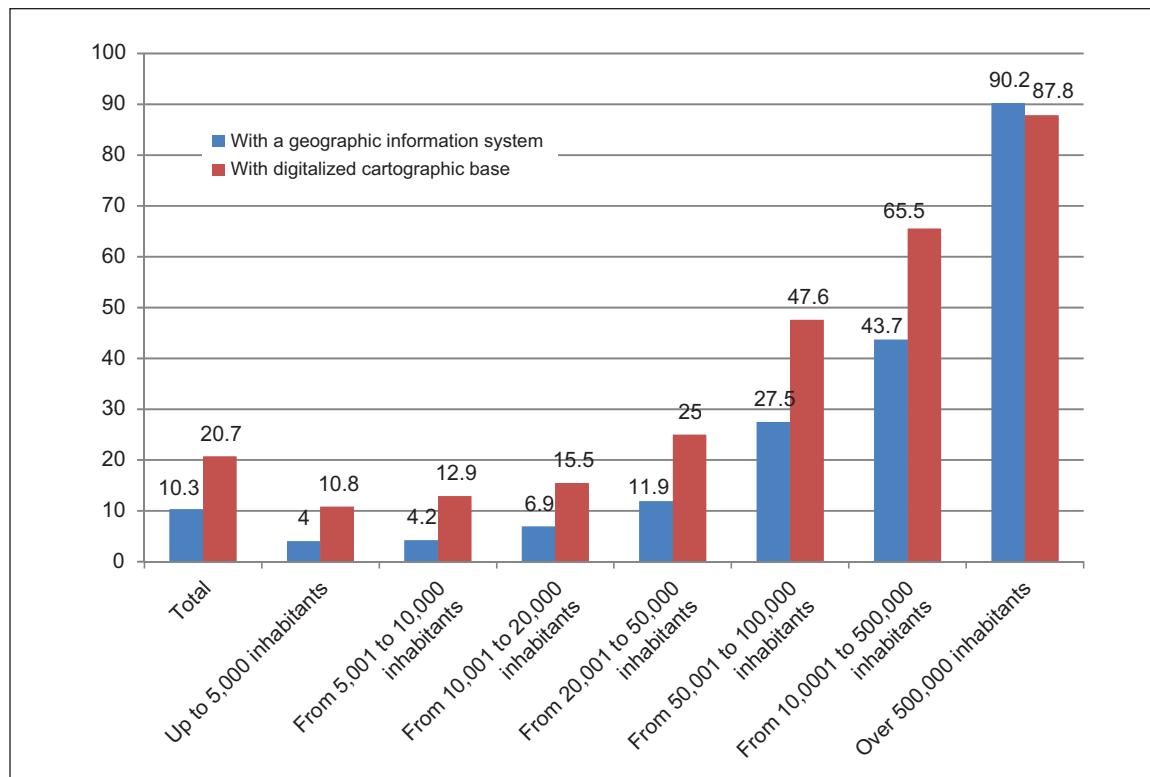
Source: Brazilian Institute of Geography and Statistics (IBGE). BRASIL/IBGE, 2016: 32.

In relation to the data and information, and especially from the ICTs, data from the National Agency of Telecommunications for 2014 show that access to personal mobile phones in Brazil is quite significant, with 280.7 million users and a density of 138 accesses/100 inhabitants. On the other hand, the access to fixed broadband is only 36.5 for every 100 homes. According to the report, "Analysis of Results- ICT Households 2014" authored by the Brazilian Internet Steering Committee:

"Ten years of monitoring ICT access and use in Brazil has revealed that half of Brazilian households are now connected to the Internet. Considering only households from urban areas, this percentage went from 13% in 2005 to 54% in 2014. If the exclusion of large portions of the population from the universe of the Internet is still a reality, it is also true that Internet use is no longer residual – which strengthens the emergence of another field of study, the impacts of Internet use at the economic, social, cultural and political levels."[10]

Access to the internet in Brazil has also advanced in the institutional context of the public administration. According to the "Survey of Basic Municipal Information," in 2012, 74.5 percent (4,146) of the municipalities had a page on the internet. In 2014, this saw an increase of 14.2 percent, reaching a coverage of 88.7 percent (4,943) of the municipalities.[11]

On the other hand, the "Survey of Basic Municipal Information" (IBGE/MUNIC) also showed that in 2015, "the national percentage of municipalities which had a geographic system of information was 10.3 percent (572),"[12] directly related to the size of the municipalities, which shows an uneven management and distribution of resources (Chart 2).

Therefore, while the numbers show the increase in internet access, the substantial lack of digitalised territorial information, being cartographic base or Geographic Information System, essential for any integrated and efficient urban planning and management activity, shows the enormous challenge related to the creation of 'smart cities' in Brazil.

Final Considerations

The 'smart city' agenda has already begun to be outlined in the Federal Government, by several public bodies led by the Brazilian Industrial Development Agency (ABDI). It is a broad agenda and involves a host of issues, including telecommunication infrastructure, which needs to be expanded to regions not yet covered by the facility, and digital inclusion programmes, which characterise the use of technological resources by the population, especially the less educated.

During the last few years, the implementation of urban policies in Brazil has shown a persistent fragility related mostly to a poor territorial approach and the absence of integration of sectoral policies, fundamental in many cases. At the same time, the use of technological solutions to overcome urban problems, from the daily maintenance activities to the more complex and structural, is practically null.

The framework of Brazil's urbanisation and the poor quality of life in the largest cities and metropolitan areas show that the need to strengthen integrated planning and management of these territories is an urgent necessity, and the participation of the population in the decision-making process is even more essential. All of this requires an integrative approach.

There is no doubt that the keyword for the construction of 'smart cities' in the Brazilian context is 'integration.' In this regard, three aspects of technology should be considered as essential for Brazil's urban policy: investment in the production of data and Geographic Information Systems at the local level; the incorporation and dissemination of technological solutions in the body of the sectoral policies, such as bike sharing and solutions for energy efficiency; and the provision of platforms for society-State interaction, at all government levels.

> "Urban policy plays an important role in shaping and changing the regional, national and even global linkages of cities [9]. Coordination of policies—across a variety of spatial scales, across organisational practices, and across all levels of governance—is of vital importance to innovation in a city. In particular, metropolitan areas are receivers of a plethora of policies from a number of bodies, but policies from different levels of governments may be often poorly coordinated, fragmented, overlapping, or even conflicting, and

thus producing perverse outcomes. Integration is not merely for technologies, systems, infrastructure, services or information but for policies. "Packages of policies," not single-focused interventions, are essential to successful innovation."[13]

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4

China's Experience with Smart Cities

– ZHENQIANG XU –

Introduction

China is creating smart cities to improve the quality and efficiency of its urban life. These cities will integrate new types of urbanisation, industrialisation, information networks, agricultural modernisation and reduction of carbon emissions. The smart city will directly impact the efficiency, quality and scope of urban revival in China. Since 2011, after studying such projects overseas, China has incorporated smart cities into its 'National Plan on New Urbanisation.' The majority of China's city managers are now familiar with the concept of a smart city: a city driven by active participation and wide promotion of information technology, combined with the internet, Big Data, cloud computing and a proactive government. The very term 'smart city' has become a buzzword in the country.

Smart Initiatives

In 2012, China's Ministry of Housing and Urban–Rural Development and Ministry of Science and Technology announced the building of three batches of pilot smart cities. The number of national pilot cities (including districts, parks and towns) has reached 277, and approval for pilot smart projects has been given to many of them. The market size of smart city is about ¥4 trillion Yuan for pilot build-up. They account for over one-third of China's county-level cities.

In March 2014, for the first time, the 'National Plan on New Urbanisation' listed 'smart city,' 'green city' and 'humanised city' as the three major goals of China's urban development. By June 2016, more than 500 cities (accounting for more than half the total number of smart cities in the world) and including 95 percent of vice-province and municipality cities, and over 76 percent of the prefecture level cities, have made 'smart city' their goal. Some have already begun construction of 'smart' features. Relying on the national smart city pilot plan, in less than three years, China has rapidly entered a new paradigm which is absorbing, drawing lessons, integrating innovation and promoting the integration of the smart city with Chinese characteristics. China has become the world's main testing ground for smart cities. Indeed, China's smart city initiative has received attention from the United States (US), Singapore, European Union and other BRICS countries.

The construction of smart cities was launched in the beginning of 2016.

China has been working on smart cities for nearly five years. The pilot projects in the 277 smart cities are creating top-level design and implementation plans, incorporating the many suggestions related to the smart city that have been made. Smart city groups have been formed and smart city offices set up by the heads of municipalities. Special funds are being established to support smart city construction. For instance, mobile-based e-governance has been started in Chaoyang district of Beijing, with an e-governance app being installed to create a 'smart Chaoyang.' Similarly, Changyang town in Fangshan district has set up a 'micro service centre' where pension is disbursed 'intelligently,' while Chongqing municipality has created a 'Liangjiang New Area' which uses intelligent applications including industry cloud services, smart energy management, intelligent transportation, intelligent energy management, intelligent urban management, intelligent landscape, intelligent environmental protection, and smart city security. Yongchuan in Chongqing pioneered the use of the public-private partnership (PPP) model to support the pilot construction of an intelligent city. Guiyang made the intelligence industry, such as Big Data cloud services and intelligent terminals, part of the core strategy of the city, and is striving to create a Chinese 'data valley.' Wuzhen Town in Jiaxing, Zhejiang, has planned the construction of an 'internet smart town.'

These intelligence applications and strategies are rapidly changing the lives of people, and they provide the basis for structural improvement and function upgrade of the giant city system. These are the examples which show how the smart city pilot is changing cities. Big Data economy, combined with the 'five modernisations' (new urbanisation, industrialisation, information networks, agricultural modernisation and lowered emissions) will give birth to the 'intellectual economy' through smart city construction.

In September 2014, India proposed a national plan of creating 100 smart cities. Smart city construction in BRICS countries, including India, should adhere to continuous innovation of theory and practice, while drawing inputs from China's experience. Smart cities will have vitality, and will be better equipped to find out what their residents need. Intelligence is the new normal state for every city's development. Smart city construction should give priority to the city's economic transformation, possessing an early-warning system to tackle urbanisation contradictions as they arise, and systems that keep improving city services, planning and operations, and maintain its ecological balance. Constructing a smart system can alleviate city problems and promote better decision-making. Using both the top-down and bottom-up approaches to promote the construction of smart cities and persisting with the combination of governmental and private enterprise, is the best way. There is a need to transform technology and production capacity, achieve top-level design, accelerate learning and draw experience from overseas, especially in the integration of innovative thinking with precise intelligence.

It is also necessary to stop thinking in terms of big platforms and an all-powerful centre, to accelerate fundamental innovations which tackle a city's real problems, and guide the information industry to meet the needs of the city. The city should not need to adapt to technology and capacity; it should be the other way round. New technologies and strategies should be used, instead of packaged solutions handed down from the top.

How Other Countries Can Benefit

India and other BRICS countries can benefit a good deal from China's experience with smart cities. The following are some possible ways:

1. It could help them understand the essence of a smart city: A smart city is essentially the innovation of city development for continuous course correction and improvement. It is a process where the policy, method, project and practice of urban planning, construction, management and operation is scientific, efficient and fair. It enables a city to continuously keep learning, correcting and improving its facilities.

2. It could lead to cooperation across borders: Conditions are ripe for cooperation in urban development across borders. Countries should focus on joint multidisciplinary research on smart cities, especially in public management, law, information technology, environmental science and engineering, architecture, city planning, industrial economics, and transportation and vehicle engineering. In the actual construction of smart cities, there should be coordination, cooperation and leveraging of skills among the concerned government departments across borders. In actual operations of a smart city, the focus should be on needs across borders, promotion of effective innovation of the internet and communications industry applications, getting the essence of top-level design of smart cities through research, and fostering effective applications that facilitate cross-linking of government functions. Paying attention to research and respecting each city's laws will build an effective city model, and promote efficiency by relying on the technology of the smart city.

3. It could bring about top-level design innovation: Smart cities should be a smart and innovative combination of the 'five modernisations.' The theoretical basis of smart cities, technological research and the innovation practices are all still in the embryonic stage. What is needed is not only innovation of a single technology, management technique or policy, but systematic, multidisciplinary and comprehensive integration solutions. The smart city shows complete, comprehensive and integrated features. For innovative thinking on the subject, especially across borders, it is important to understand each city's rules, each city's government, each city's information technology level and each industry's motivation. It requires effective practice and long-term operation.

4. It could help them adhere to some basic concepts: While turning their own cities 'smart,' BRICS nations should be aware of the latest developments across the world — the latest in development thinking, industrial ecology and collaborative innovation strategie — and draw lessons from them. They should promote cooperation in areas where sensitive data does not have to be revealed, as well as in strategies and technology innovations.

5. It could underscore the need for effective action: Smart city construction in the BRICS countries should be preceded by proper planning. Plans could be shared by the relevant committees across borders during implementation, with the overall strategy of having the single best practice. Showcase smart city zones could be built by cooperation across borders. Nine basic suggestions can be made in this regard:

- Start with city cells, focus on the development of intelligent buildings and intelligent locations, and lay the foundation for constructing an intelligent location.
- Set up a smart city area in the urban core (key development area), promote the concept of combining industry with the city, build smart city business incubators, and create business start-ups and innovation bases.
- Create a comprehensive service provider for the smart city, integrate urban governance, and provide adequate collaboration and innovation.
- Promote talent in innovation and encourage entrepreneurship.
- Ensure that technical regulations and guidelines keep pace with construction of the smart city.
- Acquire complete knowledge of the complexity of the area, its population, industry and so on, and utilise it fully while building the smart city.
- Understand and improve the city's functioning, using innovations possible with information technology.
- Take the lead in building a dynamic, visual and quantitative decision-making platform for the city.
- Fully exploit local advantages and conditions and existing open-source data and construct smart applications and innovative platforms which everyone can easily access.

6. Suggestions for China–India cooperation: There are at least eight ways in which China and India, both important countries at a critical stage in their urbanisation, can cooperate:

- Establish a long-term mechanism for exchanges and cooperation, such as a think tank, with experts drawn from both countries.
- Integrate smart industry with the smart city to benefit from scale.
- Make a combined effort to raise finance from different sources for smart city projects, with policy incentives to facilitate building of smart cities.
- Deepen India–China inter-ministerial cooperation and build innovation engines.
- Support market-driven development, open up areas to the private sector and promote information consumption.
- Take people's livelihoods into consideration while devising strategies, develop appropriate solutions and implement intelligent applications.
- Focus on key areas together to achieve major breakthroughs.

5

LIVED Shanghai and the Development of Chinese Smart City

– YANG LI –

In the past several years, Chinese conception of the idea of 'Smart City' has evolved, just like it has among people of other countries. The early image was a 'green city,' or 'Eco City' as officially phrased. Later came the idea of a 'Sponge City,' and then, 'Humanity City.' These different types emphasised the various parts of urban life. Today, 'smart city' is an integrated concept that benefits from innovations on the previous ideas. In August 2014, eight different ministries of China issued the document, 'The Promoting Smart City Sound Development Guidance,' which proposed that a group of smart cities be constructed by 2020. By then, their aggregation and competitive advantages would have been strengthened, including improvements in civic livelihood, innovations in social governance and the maintenance of cyber security, among others.

The Process of Chinese Smart City Building

According to the *Plan of National New-type Urbanisation* (2014-2020), which describes the direction to be taken by China's smart city, six specific goals are to be realised. These are: (i) wideband network; (ii) management of information technology; (iii) intelligent infrastructure; (iv) convenient public service; (v) modern industry; and (vi) good governance.

To meet these goals, various guidelines and policies have been drafted, including:

- "National Smart City Pilot Project" of Ministry of Housing and Urban-Rural Development, in which 299 cities and districts were involved;
- "National Information Consumption Pilots Cities Project," "China and Europe Green Smart City Cooperation Pilot Cities Project," "Smart City Pilot Project with Zhejiang Province," "Smart City Pilot in Guangzhou and Yangzhou" of Ministry of Industry and Information Technology;
- *Issued Carry Out Government and Social Investment Cooperation Guidance and Issued Government and Social Capital Cooperation Projects General Guidance* of National Development and Reform Commission;

- "National High Technology Research and Development Programme (*863 Programme) of China-Smart City Survey" and "Smart City Pilot Project with 20 Cities" of Districts of Ministry of Science and Technology;
- "Smart Public Transportation Pilot Project in 10 Cities" and "Smart Taxi Management Project" in 25 Cities of Ministry of Communications;
- "Safe City Project in whole China" and "Automatic Alarm and Monitoring Network System Pilot Project in 473 Cities" of Ministry of Public Security;
- "National Smart Tourism Pilots Cities Project," involving 33 cities, of National Tourism Administration; and
- *Issued Government and Social Capital Cooperation Projects General Guidance* of Ministry of Finance

Currently, the expansion of the smart cities group is being considered. This would imply more competition—and coordination—between cities and regions for talent, funds and industries. Demanding more concern are various details like the basic unit (for example, smart community, parks, micro-city, among others). There is no doubt that the road towards fulfilling the end-goals of the construction of smart city—among them, economic development, social justice, and a healthy environment—is a long one.

Smart City Building in Shanghai (2014-2016)

Shanghai was among the earliest cities in China to initiate the building of a 'smart city.' In 2012, the Shanghai municipal government issued *The 12th Five Year Planning Guidelines of Shanghai National Economy and Social Development* (《上海市国民经济和社会发展第十二个五年规划纲要》), which mentioned for the first time the concept of building a 'smart city.' Four years since, it has come into being. Four specific perspectives are taken care of:

- to meet the people's demands, i.e., build the smart city for the people and focus on their daily lives, enterprise's daily operation and various needs of different departments of government;
- application to be strengthened by innovation. To encourage all kinds of creation of technologies, modes and industries;
- assurance of security. Stick to the idea that cyber security and informatisation are like two wings of one body; and
- guidance from the government, which will provide incentives to private enterprises to execute the plans.

The goals of Shanghai Smart City building were emphasised in the Guidelines. In 2016, these include building a next-generation urban information infrastructure system, a green high-end information technology system, and an independent and trustworthy cyber security system. These will become key components of the Shanghai Smart City building.

- Informatisation: to improve information consumption; to set up an intelligent system of medical care, education, public transportation, and provisions for the elderly. This depends on the Four New (new technology, new industry, new mode, and new format). The integration index of informatisation and industrialisation should be 86.5. The e-commerce share should be ¥2,000 billion. The e-government administration has been improved, with the goals of having intelligent community, intelligent village, intelligent trading area, intelligent industrial zone, and intelligent new town.
- Service level of next urban information infrastructure to be accelerated: to build broadband inclusively and completely. Next Generation Broadcasting (NGB) covers six million households, with 3G and 4G usage covering 70 percent of citizens. WLAN input at more than 200,000.
- New information technology (IT) industries to be improved for high-class software and independent innovation. To encourage more modes and formats of companies to join the areas such as Big Data, cloud computing, Internet of Things (IoT), and mobile internet. Shanghai has been the centre for these kinds of industries. The new IT industry is worth ¥1,000 million, covering 70 percent of information industries. Some 800,000 are employed in this new area, and the gains from the information sector could reach ¥680 billion.
- Cyber security to be improved for key area safety surveillance, emergent cyber security management, integrative cyber space management and cyber security awareness.

Two driving forces could be considered crucial for promoting smart city building in Shanghai. One is the new technology based on internet, cloud computing, and the IoT. The other is innovative urban environment. A successful smart city building plan could, therefore, use the two factors together. Here, a perfect example is LIVED Shanghai.

LIVED Shanghai

This idea has recently been implemented. The five letters separately refer to five important parts of people's daily lives:

- L means Livable, referring to smart lives;
- I, Innovative, means high-end economy;
- V, Viable refers to perfect municipal management;
- E refers to Efficient, integrated political administration; and
- D, District, covers new landmarks in village, trading centre and industrial zone (See Table 1).

Challenges confronting Shanghai

"We cannot let the gap between different groups to be wider." According to the Deputy Director of the Shanghai Economic and Information Committee, Liu Jian, the integration of downtown center and the suburbs area or countryside remains a big challenge for a complete success of

Table 1: 28 Building Special Items of LIVED Shanghai

L = Livable	I = Innovative	V = Viable	E = Efficient	D = District
1. smart transportation 2. smart health 3. smart education 4. smart aged provision 5. smart culture 6. smart travel 7. smart employment 8. smart weather report	9. internet finance 10. smart shipping 11. smart business 12. smart manufacture 13. smart industry	14. informatisation of urban integrated information 15. informatisation of food security 16. informatisation of environment protection 17. informatisation of public safety 18. intelligentisation of urban livelihood	19. integration of E-political administration 20. open service of government public data 21. perfection of public service 22. improvement of E-political administration cyber service 23. service platform of public credit information	24. smart community 25. smart village 26. smart trading center 27. smart industrial park 28. smart new town

Note: For example, the WeChat app as an important tool. Citizens could use this app to search for weather report, to pay daily bills, to apply for a passport, and to check the records about violations of rules. During the initial week, nearly one million people used the app to access information. The top uses, suggesting the most important of people's concerns, were the following: registration in a hospital; driving license points; weather reports; and paying electricity bills.

Smart City building. Besides, there are also technical problems. The average internet speed ranks 79th in the world. Shanghai therefore needs to upgrade the current smart city mode.

First, the top-layer design including infrastructure (like the arrangement of industry, community, and supporting facilities) should be given more attention. Second, it is necessary to maintain the trend of information openness and stimulate more public involvement. Meanwhile, the political information centre must be established and perfected. Lastly, the internet of industries will be the next important thing to follow, as it will breed the new economic growth areas.

Big Data and Smart City Governance

China has played an important role during the development of big data, which covers nearly every aspect of life in Shanghai—from financial industry, insurance, communication, stock market, logistics, mail express and electronic business. In the past, there has never been so many cases of Big Data flows in inland China. The data warehouse and analysis skill could not meet with the demand and the reality. But at present, companies like Teradata are able to deal with 41 petabytes

(PB) level cases, five of which are from China.

The Director of the Shanghai Information Centre, Wenkai Yu, has said that smart city could be understood as an intelligent system and social environment where data could be collected, identified, connected, stored, integrated and analysed. Big Data stage has come and it means that everybody can enjoy from this process as it has become increasingly convenient. Thus the traditional smart city idea could not meet with current needs.

In September 2015, the State Council of China published the *Guidance of Improving of Big Data Action*, which focused attention to the important influence of Big Data on the perfection of municipal governing ability. It is also supported by many scholars, public servants, and business leaders. They all agree that the two in the current stage are strongly connected. In this guidance, Big Data was defined as the national fundamental strategic resource. The guidance required that all parts should emphasise the innovative development of Big Data and the reasonable arrangement of it, which stands for the inner demand and an inevitable choice for a stable growth, an improved reform, an adjusting structure, a beneficial welfare and modernised municipal governance. Based on these assumptions, China will depend on Big Data to build a new social governance mode with precise governance and multiple cooperation in five to 10 years.

The first priority for the Chinese municipal government is to immediately realise the opening and sharing of government information system and public data internet. Openness of information is a key issue here. It was considered very important for the government to integrate its information platform, wiping out information island, and keep working on the openness of information to the public. In this respect, it will help with upgrading public trust in government. Social progress and public enterprises will thus benefit from it.

Experts in China use four words to describe the dramatic changes happening as the country enters the information and technology age: "big," "wise," "mobile," and "cloud." 'Big' refers to the amount and intensity of the data. 'Wise' refers to the intelligence. 'Mobile' refers to the internet, the IoT and the instant handling of information, while 'cloud computing' is now a trend.

So how does Big Data support the upgrading of government service? In China, there are three internet tycoons BAT (Baidu, Alibaba, and Tencent) who act like the pioneers in this process. Take Tencent for example—it signed treaties of big-data-based political service system with the Guangdong municipal government. Tencent will be the service technical provider, supporting the internet offices of Guangdong municipal government and the political issues cloud. Besides, it also builds a complete WeChat "municipal service" network, providing transportation, public security, welfare and housing information. Tencent is also the partner of Shanghai to build "internet + smart city." Besides the mentioned areas, culture, education, logistics, entertainment, travel, and intelligent automobiles are all included in this cooperation.

"After the value of these data has been discovered, modernisation of the whole national and municipal governance ability will be improved and everyone's life will be deeply influenced" (Li Yu, Chairman of the Board, Longxin Data Limited). Longxin has been working with related departments on analysing and processing key data information such as company register. They started a research group on "enterprise development and macro economy." According to Li, Big Data offers government this opportunity to turn market surveillance into instant monitoring, and respond more quickly to illegal economic behaviours. Big Data could be a great helper given the time, energy, and human resource saved by it, and the new management concepts and modes.

At present, four key words are considered to be crucial to Big Data development: openness, standard, industry, and safety. At the same time, they represent the major challenges. In the Guidelines, three major tasks are defined to solve the problem:

- to integrate government information share platform and to improve the management. Cities like Beijing have already built Big Data platforms. Beijing Science and Technology Committee collected related resources to set up a "Capital Science and Technology Big Data Platform," open to society so they could acquire data from medical research, transportation information and finance data;
- to promote industry innovative and to foster new industry mode, in accordance with economic transformation; and
- to strengthen security level and to encourage health development.

According to Li, several departments are not willing to share information with the public or other departments, and it has caused damage to the whole development process. This compulsory system of sharing has forced each department to open their information resources and integrate industry and government information together.

The Director of Information Studies at the Centre of Shanghai Social Science Academy, Shiwei Wang, holds the same view. He argues that the root of Big Data is internet thinking. To build a successful Smart City, we must give up on the traditional isolated way. Moreover, we need to conquer our old habits of neglecting data collecting. He suggested that to have more Big Data with high quality, a long-term information management system should be established, based on co-building, co-conceiving, co-having. In this way, Big Data could expand beyond information boundaries to realising the process from information island to internet platform.

Conclusion

The core of the Smart City, the trend of tomorrow's city, will always be people first, and then the industries. The manager is another important part. Therefore, it is important to always consider people in the first place and use the data in the right way. A Chinese saying goes: "To master things rather than being mastered by things." It could also be applied to the relationship between technology, Big Data and smart city. We must bear in mind that the purpose of smart city building is the good of human life, so it is crucial for us to master technology and Big Data rather than being mastered by technology and Big Data.

6

The Digital Life of Key Russian Cities: Current State and Dynamics

– VLADIMIR KOROVKIN –

Digital Transformation and a City: The Research Prospective

Cities are at the heart of the current socio-economic order in almost every country in the world, and this role is growing. According to the United Nations (UN), in 2015 the world passed the 50-percent threshold in urbanisation, and the share of population living in the cities will grow to 60 percent by 2030 and further to 70 percent by 2050. It is in these cities where economic power is concentrated: according to Oxford Economics, the 750 biggest cities of the world contribute 57 percent of global GDP.[1]

Such dynamics lead analysts to conclude that the global competition of the 21st century will be one among cities, rather than nations. People and corporations alike increasingly tend to make their strategic choices not between, say, Brazil, the United States (US) or Russia, but between Sao Paolo, Houston or Moscow. In a sense, the world has gone back to the era of ancient Greek *politeia* or medieval African city-states, the independent nodes in a global network of business, political and cultural relations, which compete with each other for residents, trade and glory.

In the process of the growing prominence of cities, what role is played by the so-called 'digital transformation' – i.e., the penetration of computer-based systems into all spheres of life with the mounting exchange of information signals and data arrays? The digital systems change the everyday lives of people, their living environments and businesses in which they are employed. These systems are known for their capability to create the 'network externalities' (or 'positive feedback loop') when each new instance or application increases the value for the users of all the already existing ones.

An example of such effect in the urban context can be the development of modern cashless technologies, for example, based on NFC (near-frequency control) technology with the use of cards or smartphones. The technology allows a 'one-touch' payment for services of the mass transportation, increasing the throughput of payment points and, thus, raising their efficiency. The technology works in the same way for small retail, including street-food outlets. On the other hand, the easiness of use of the technology for the customers encourages them to acquire special cards or phone apps and deposit certain sums of money on the linked accounts.[2] This liquidity, in turn, can be used within various business models of the companies working in the realm of

'digital financial technologies' – e. g., for crowdfunding, peer-to-peer (P2P) lending, microsavings and microinsurance, among others. Such chain of effects can be almost endless.

The modern discourse on urbanism has begun to revolve around the concept of 'smart city.' There are concurring views on what exactly is at the core of the idea and which instruments are most effective in bringing it to life. On one hand, there is the 'technocratic' school, which promotes the vision of complex all-connected city systems, from utilities to traffic management, based on data-collecting devices and fully run by artificial intelligence. An alternative reading of 'smart,' meanwhile, puts an accent on the high quality of human capital of the residents and their proactive participation in the life of a city and its communities. The development of digital technologies allows for the creation of environments which are based on the effective cooperation and collaboration of people and computers. The true 'city of the future' probably pursues the effective use of digital applications towards fulfilling the goals of comfortable collaboration and spiritual development of its inhabitants.

The present research project of the Institute for Emerging Markets Studies of the SKOLKOVO School of Management (Russia) is one of the few attempts to introduce a quantitative measurement of the depth of penetration of digital technologies into the life of modern cities.[3] The research methodology aims at capturing the key aspects of modern city life, among them: transportation, finance, retail trade, healthcare, education, media and administration, measuring independently the development of demand and supply. This separation of measurement is important, as the inertia of human behaviour and the lack of relevant skills often pose a strong barrier for the penetration of all sorts of innovations into everyday life. On the other hand, in some cases where the consumer is quick to adapt to new technologies, the supply side may lag behind in offering relevant business models and applications.

This research is focused on the 15 biggest cities of Russia, each with a population of over one million people. As a rule, the bigger cities are quicker in creating the critical mass of technology and involved users, which then switches on the mentioned positive network effects. As the Russian regions are markedly different in their economic resources, comparing them can provide important insights on the relation of the processes of digital transformation to the state of development of traditional economy. Do the new technologies 'follow the money,' bringing more opportunities to the already more developed regions? Or are they used to overcome the limitation of traditional resources and 'leapfrog' in development? This was the key question of the current research project—the Index of Digital Life of the Russian regional cities.

Russia: Marked Unevenness of Regional Development

The economy of modern Russia has a strong discrepancy between the level of resources of the 'capitals' (Moscow and St. Petersburg) and most of the other regions. There is a slow process of convergence; still a typical region has the Gross Regional Product (GRP) per capita in the range of 25-30 percent of the level of Moscow (Figure 1).

There are certain disproportions in the penetration of digital technologies as measured by the share of population with regular access to the internet. The variation within the sample of the 15 biggest cities was from 90 percent of adults accessing the internet at least once a month in

Figure 1: Dynamics of Changes in per capita GRP in the Russian Regions relative to Moscow
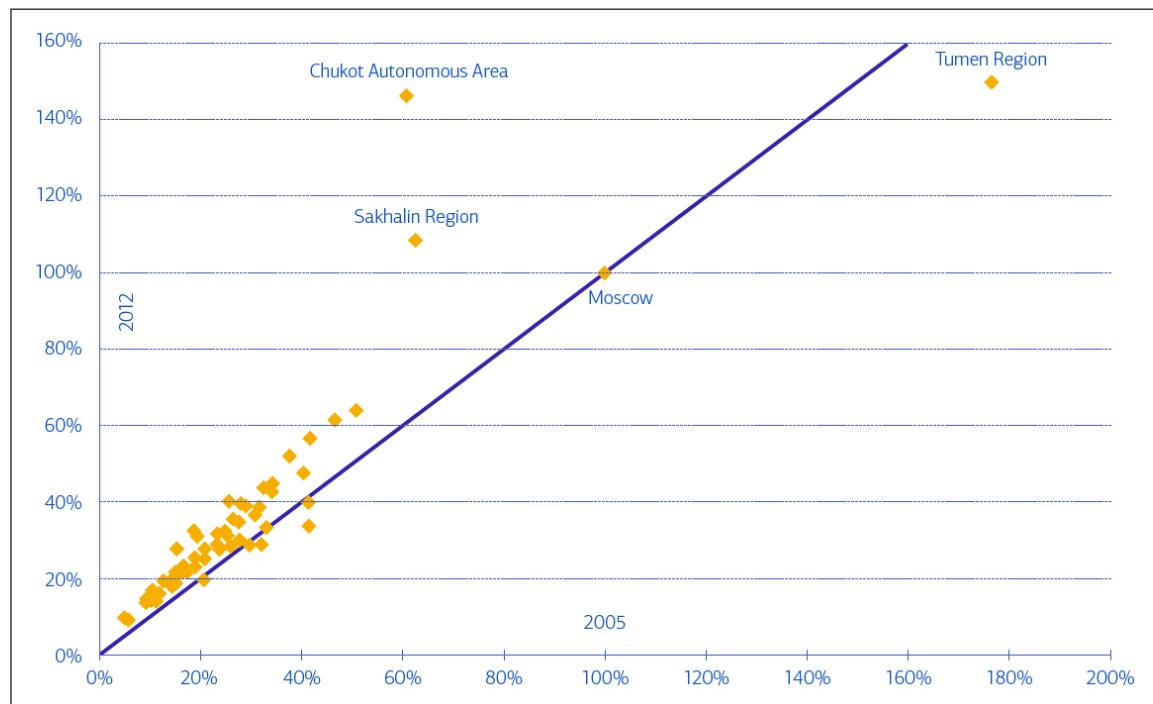
Note: The regions which are above the diagonal line converge with Moscow, those below diverge.

Source: State Statistical Committee of Russia (Rosstat).

Moscow to a little over 70 percent in Perm or Volgograd. One of the key questions in this research is whether this measurement of penetration is in direct proportion to the depth of use of digital technologies or there exists a more complex relation.

The 15 Biggest Cities: Secondary Digitalisation

So far, most comparative measurements of digitalisation (the ICT indices) have focused on the analysis of the possibility to access the internet, i.e., the connectivity of a country or a region, sometimes combined with the frequency of usage by an average consumer. This approach works well in screening out the territories or industries which are in a relatively early stage of penetration of digital technologies, the 'primary digitalisation.'

Yet, with the growth of connectivity, its measurement ceases to be analytical enough, as the quantity of users after a certain threshold loses correlation with the quality of the digitalisation: the goals, modes of usage, diversity and relative strength of the participants of the digital networks. We call this accumulation of quality the 'secondary digitalisation'; this is the process which becomes increasingly important in the economies across the globe.

Table 1: Key Economic Indicators of the 15 Biggest Cities of Russia

City	Population (people)	GRP per capita (roubles)	Industrial Output per capita (roubles)
Moscow	12 108 257	873 536	185 089
St. Petersburg	5 131 942	446 615	455 188
Novosibirsk	1 547 910	241 471	57 960
Yekaterinburg	1 412 346	343 557	41 220
N. Novgorod	1 263 873	255 554	60 277
Kazan	1 190 850	374 365	47 782
Samara	1 172 348	293 225	57 923
Chelyabinsk	1 169 432	241 630	94 067
Omsk	1 166 092	252 549	267 545
Rostov-on-Don	1 109 835	197 926	40 183
Ufa	1 096 702	283 584	103 251
Krasnoyarsk	1 035 528	418 044	56 401
Perm	1 026 477	340 496	187 887
Volgograd	1 017 985	223 383	122 143
Voronezh	1 014 610	244 143	37 356

Source: Rosstat.

The Institute for Emerging Markets Studies estimates the threshold of secondary digitalisation to be at the level of 60-70 percent of adult population being regular users of the internet. This threshold was passed in 2015 by all of Russia's 15 biggest cities. This level of penetration allows building of complex digital systems, which will be used by the majority of the population with digital-savvy actions turning into the mainstream of societal behaviour. This, in turn, should launch the process of the creation of positive network effects in a relatively short time.

The secondary digitalisation is measured by the Index of Digital Life developed by SKOLKOVO IEMS, which accounts for the development of the supply of the digital systems and consumer demand for them in seven aspects of modern urban life: transportation, finance, retail, healthcare, education, media, and public administration. The overall score of each city represents the degree of its secondary digitalisation relative to other cities in the sample (the bigger the score, the higher the development).

The process of secondary digitalisation of Russian cities is very rapid. Within a year, the average score of the Index of Digital Life increased by 50 percent, from 0.38 to 0.55. The three leading cities in both years were Yekaterinburg, St. Petersburg and Moscow (uncharacteristically

Figure 2: Dynamics of Penetration of Internet, 2014 – 2015
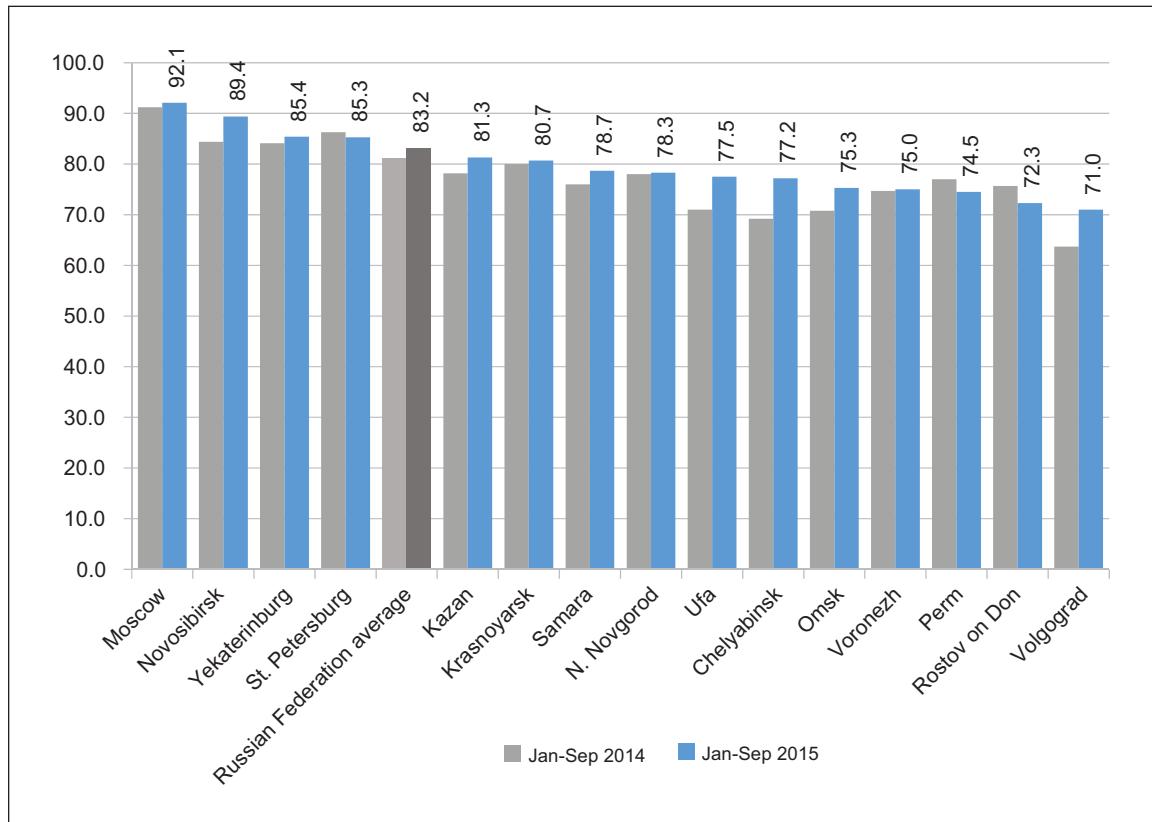
Note: % of adults accessing internet at least once a month.

Source: Public Opinion Foundation.

for Russia, the latter is not ranked first). Volgograd and Voronezh remained at the bottom of the list. Rostov-on-Don was the fastest growing city in digitalisation.

Through the combined analysis of the current state and the dynamics of the digitalisation, the IEMS study has come up with four groups of cities:

i)   Strengthening the leadership: those who have high scores, yet continue to grow faster than the leader of the ranking – Novosibirsk, Kazan, Moscow and St. Petersburg;

ii) Stagnating leaders: those who have high scores, yet are slow in growth – Perm and Krasnyarsk, which were in top-5 in 2014, yet moved to the middle of the ranking;

iii) Chasing underperformers: those with low current scores yet high dynamics – Rostov, Volgograd, N. Novgorod, Ufa and Chelyabinsk; and

iv) Lagging underperformers: low scores with weak dynamics – Samara, Voronezh and Omsk.

Figure 3: The Dynamics of the Index of Digital Life, 2014 – 2015
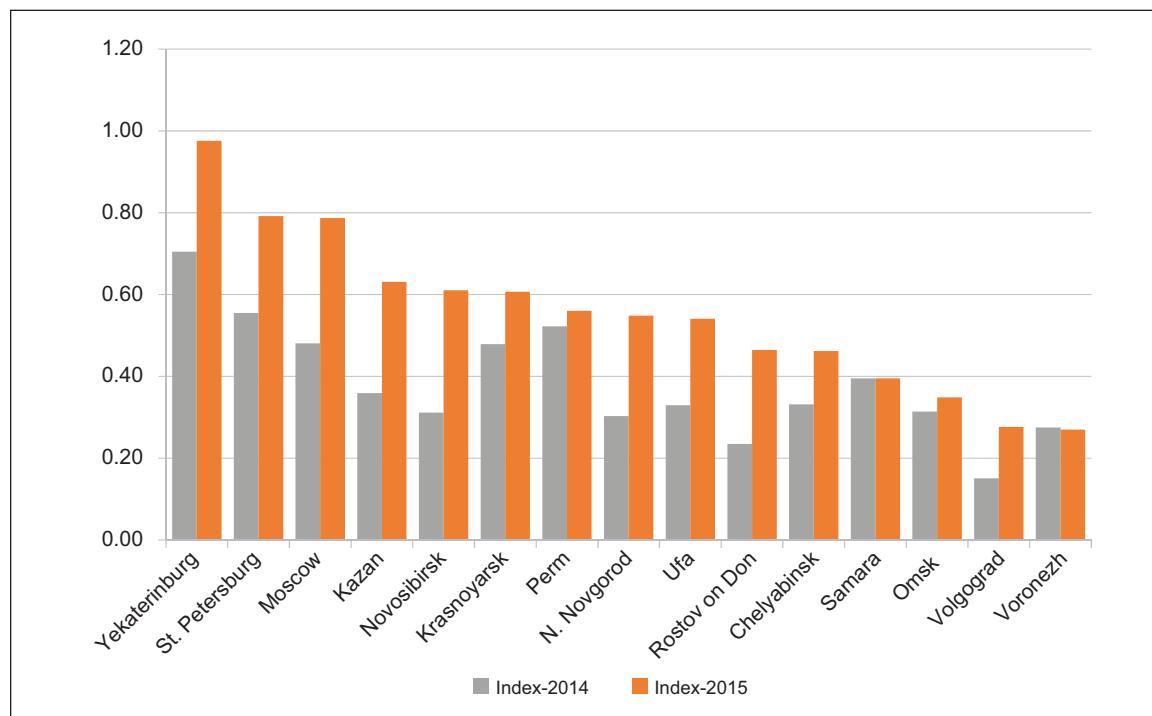
Source: SKOLKOVO IEMS Research.

Figure 4: The Four Groups of Cities by the Dynamics of Digitalisation
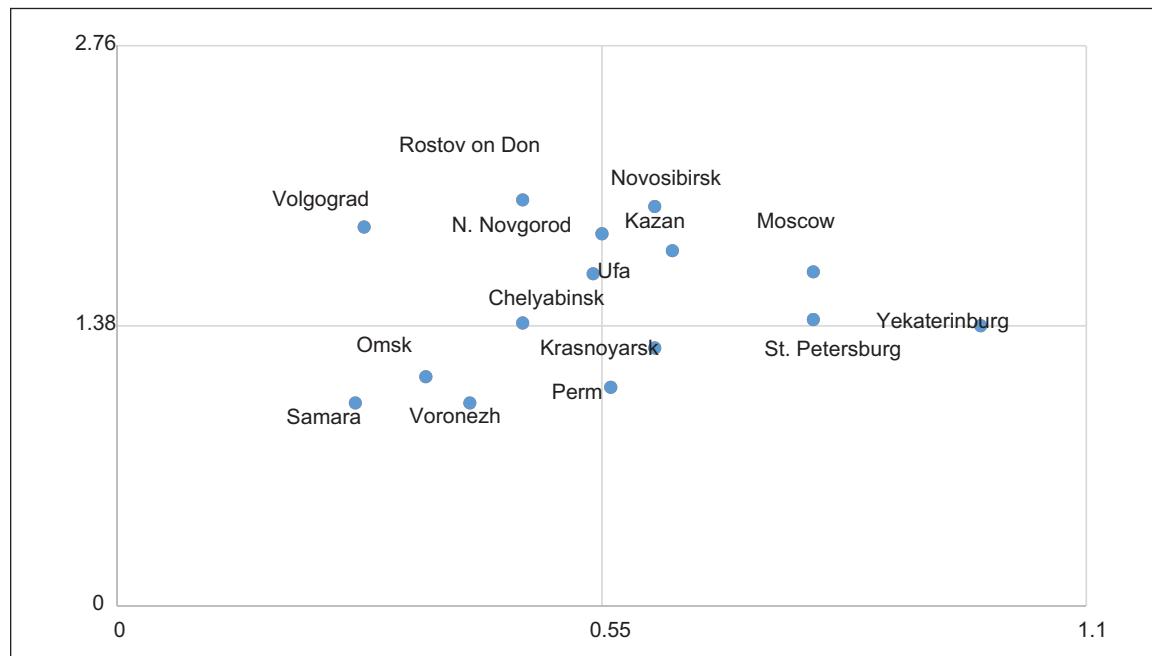
Source: SKOLKOVO IEMS Research.

The growth of the Index is mostly driven by the development of the demand; its average score has almost doubled within a year, from 0.39 to 0.73. The supply side was lagging behind and the average supply score in 2015 (.037) was slightly below that of 2014 (0.378). There was marked decrease in supply in Perm, Voronezh, Krasnoyarsk and Yekaterinburg. This unexpected dynamic was largely the result of economic recession which drew some local players in finance with strong digital offer out of business, as they did not have enough of the size to compete with national leaders and meet the regulatory requirements. As a result, the digitalisation of finance came with overall negative score in 2015.

Overall, there was marked drop in the correlation between supply and demand, as the correlation coefficient fell from 0.7 in 2014 to 0.4 in 2015.

Figure 5: Demand-side Development, 2014 – 2015
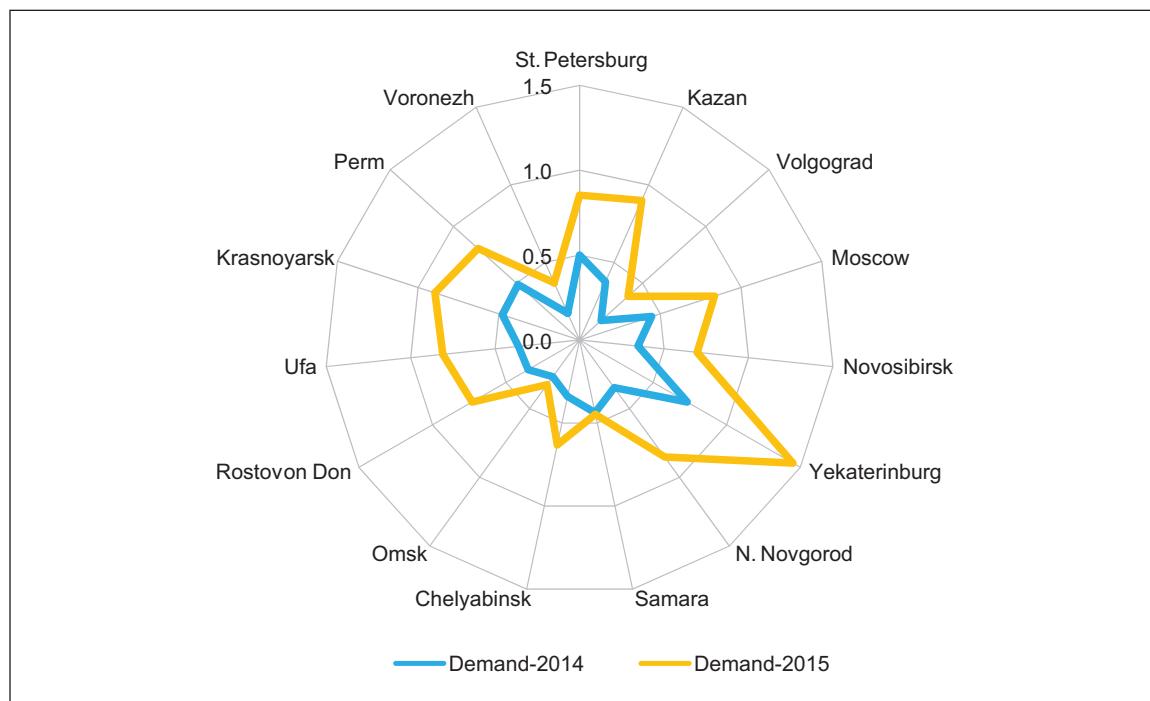
Source: SKOLKOVO IEMS Research.

Supply and Demand by City

With the detailed analysis of development of supply and demand by regions, two separate models emerge. There are cities with levelled performance across all seven aspects and cities with marked specialisation. These models are not related to the overall development of either supply or demand, e.g., cities like Kazan or St. Petersburg, which are at the top of the rankings, are strong specialists, while Samara in demand or Rostov in supply (both being in the bottom of the rankings) show a very levelled performance.

Figure 6: Supply-side Development, 2014–2015
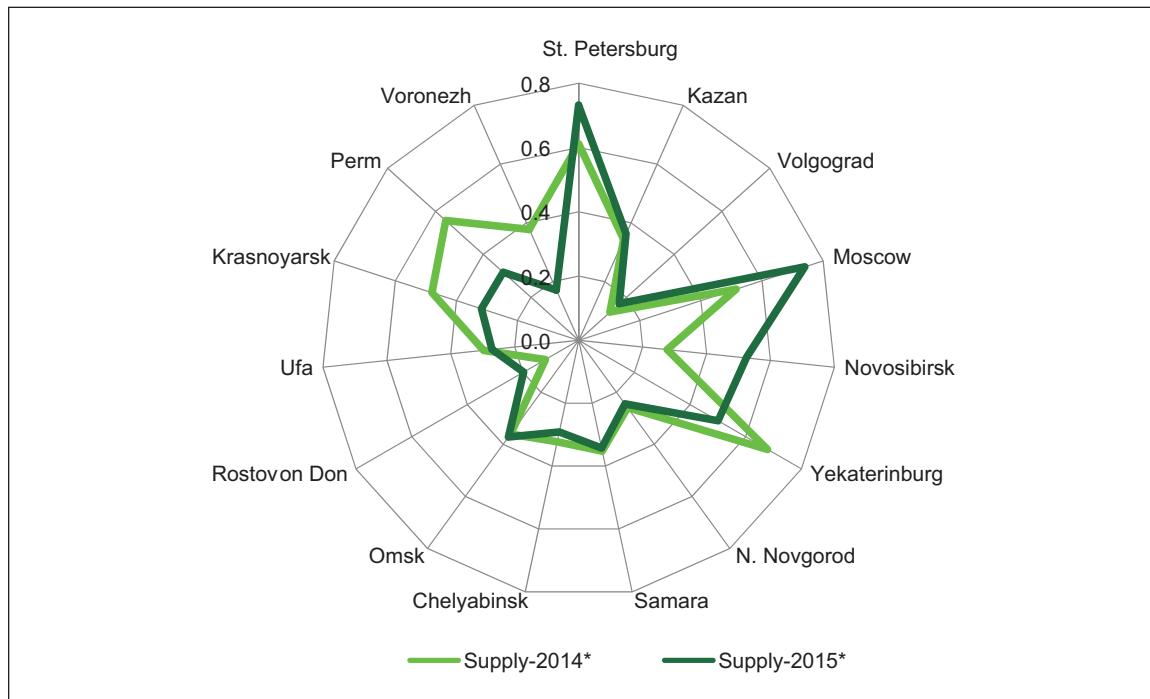
Source: SKOLKOVO IEMS Research.

Among the four measured aspects of life, education demonstrates the highest degree of variation, while public administration is the most consistent.

Conclusion

As discussed earlier, the key question behind the research was whether the secondary digitalisation, i.e., the development of the quality and complexity of digital systems, is directly proportional to available connectivity on one hand, and the available economic resources, on the other. The analysis of the Digital Life Index gives important insights on both questions.

i) Relation between secondary and primary digitalisation: While there is some expected correlation between the rate of population accessing the internet and the degree of development of the digital systems, it is nothing close to direct proportionality. For example, even as Yekaterinburg is the leader of the Digital Life ranking, it comes only third nationally in the share of population going online. At the same time, Novosibirsk is #2 nationally in connectivity, but comes only 5th in secondary digitalisation. A similar picture is observed in the bottom of the ranking. Generally, the IEMS hypothesis holds true: that there is a 70-percent threshold in internet penetration, after which the further quantitative growth ceases to be the defining factor of qualitative development;

Table 2: Relative Development of Demand by Region

Demand	Transportation	Finance	Retail	Healthcare	Education	Media	Public Administration	Average (total demand)
Yekaterinburg	0.87	1.91	0.72	1.01	3.86	0.96	0.81	1.45
Kazan	0.12	0.81	0.6	0.07	1.15	0.81	2.73	0.9
Krasnoyarsk	0.42	1.25	0.36	0.9	2.53	0.66	0.14	0.9
St. Petersburg	0.34	1.39	0.87	0.53	1.58	0.74	0.51	0.85
N. Novgorod	0.55	0.81	0.27	0.42	2.9	0.39	0.63	0.85
Moscow	0.38	0.28	1.28	0.43	1.03	0.89	1.55	0.83
Ufa	0.35	0.35	0.18	1.01	2.34	0.5	0.94	0.81
Perm	1.3	1.11	0.22	0.49	1.74	0.44	0.32	0.8
RostovonDon	0.4	0.34	0.22	0.25	2.53	0.57	0.81	0.73
Novosibirsk	0.48	1.13	0.5	0.09	1.53	0.69	0.46	0.7
Chelyabinsk	0.41	0.68	0.25	1.19	1.07	0.64	0.18	0.63
Samara	0.1	0.53	0.31	0.08	0.95	0.71	0.45	0.45
Volgograd	0.05	0.34	0.15	0.07	1.51	0.48	0.08	0.38
Voronezh	0.35	0.73	-0.04	0.14	0.85	0.32	0.22	0.37
Omsk	0.12	0.55	0.03	0.05	0.74	0.46	0.34	0.33
Average	0.416	0.814	0.394667	0.448667	1.754	0.617333	0.678	0.732

Note: Red indicates very strong above average performance, light red indicates strong above-average performance, blue indicates strong below-average performance.
Source: SKOLKOVO IEMS Research.

ii) On the relation of secondary digitalisation with the economic resources of a region (as measured by GRP per capita, size of population, and absolute GRP), there is important difference between supply and demand. The supply-side development indeed shows strong correlation with the stated indicators, though size of the population seems to be more important than its relative wealth (GRP per capita). The explanation may be that it is the size, not the intensity of a system, which brings more of the network externalities, which drive the economic efficiency for the suppliers. On the demand side, there is no meaningful

Table 3: Relative Development of Supply by Region

Supply	Transportation	Finance	Retail	Healthcare	Education	Media	Public Administration	Average (total demand)
Moscow	0.78	-0.25	0.5	1	1.17	1	1	0.74
St. Petersburg	0.47	-0.13	1	0.8	1.52	0.17	1	0.69
Yekaterinburg	0.42	-0.02	0.68	0.93	0.38	0.25	0.8	0.49
Novosibirsk	0.5	0.01	0.37	0.53	0.68	0.15	0.9	0.45
Kazan	0.88	-0.36	0.33	0.6	0	0.22	0.7	0.34
Perm	0.62	-0.58	0.64	0.53	0	0.04	1	0.32
Samara	0.42	-0.32	0.2	0.87	0	0.09	0.75	0.29
Krasnoyarsk	0.5	-0.58	0.3	0.77	0	0.1	0.9	0.28
N. Novgorod	0.25	-0.23	0.74	0.3	0	0	0.9	0.28
Omsk	0.46	-0.47	0	0.47	0.4	0	1	0.27
Chelyabinsk	0.44	-0.43	0.21	0.6	0	0.1	0.85	0.25
Ufa	0.25	0.01	0.16	0.4	0	0.04	0.7	0.22
Rostov	0.25	-0.43	0.41	0.37	0	0.07	0.8	0.21
Voronezh	0.5	-0.31	0.4	0.07	0	0.01	0.6	0.18
Volgograd	0	-0.28	0.38	0.33	0	0.02	0.8	0.18
Average	0.44	-0.29	0.42	0.57	0.27	0.15	0.84	0.346

Note: Red indicates very strong above average performance, light red indicates strong above-average performance, blue indicates strong below-average performance.

Source: SKOLKOVO IEMS Research.

correlation with either of the economic indicators. The only relation that has been observed was with the index of Quality of Life, a rather 'soft' measure which aims to capture the degree of satisfaction of residents with their urban environment. The degree of correlation was high (over 0.7), which suggests that digital technologies become an integral part of modern life for the majority of population at least in the biggest urban areas.

Endnotes

1   http://www.oxfordeconomics.com/cities/report.

2   For example, in the US, the average amount of deposits in the mobile payment app of Starbucks network exceeds $1 billion, which is comparable to deposit base of a mid-size American bank.

3   Some international projects which are close in the overall research spirit – though different in the view of the phenomenon and methodology – are the indicies Cities In Motion by IESE business school (Spain) and Innovation Cities by 2ThinkNow company from Australia.

7

Technological Platforms for Intra-urban Planning and Social Participation in Public Policies: The Experiences of Human Development Atlas, Social Vulnerability Atlas and Participa.br

– BÁRBARA OLIVEIRA MARGUTI –

Introduction

This paper presents two initiatives by the Institute of Applied Economic Research (IPEA, Brazil), which have helped in developing technological platforms. The first initiative provides economic, social and urban data to intra-municipal scale in Brazil's metropolitan areas. The second initiative provides a channel for direct interaction and social participation of the civil society to contribute towards Brazil's report for the Third United Nations Conference on Housing and Sustainable Urban Development (Habitat III).

Both experiences demonstrate the significance of user-friendliness and transparency of government information and the potential of opening spaces, through virtual tools, for participation and interaction of civil society in building guidelines for the future of cities. This paper highlights the potential for expanding such democratic participation by providing digital tools. It also examines how the UN Sustainable Development Goals (SDGs) extend the possibilities for creating monitoring indicators for socio-economic and environmental advances, along with the development of virtual spaces to make this information easily available.

The Construction of Socio-economic Indices and Interactive Platforms

Since 2012, IPEA has undertaken research on the human development theme in partnership with the UN Development Programme (UNDP) and João Pinheiro Foundation (FJP). Their first collaborative effort was to adjust the Human Development Index (HDI) – used to compare the level of human development between nations[1] –in the *Municipal Human Development Index* (MHDI). The MHDI uses socio-economic indicators from nation-wide research – such as the 2000 and 2010 Census—to make Brazil's HDI more realistic in expressing its population human development conditions.

MHDI is a composite of seven indicators and is organised into three dimensions: longevity, education, and income. For this project, however, more than 200 socio-economic indicators were calculated to "support the MHDI analysis and extend the understanding of the phenomena and dynamics the municipal development is facing."[2] These indicators are related to urban infrastructure, social vulnerability, demography, and reference population, all available for consultation in the *Human Development Atlas* (HDA).

The MHDI project was unfolded as part of a new initiative, involving the combination of 16 indicators from the 200 in the HDA, which are focused on the social vulnerability of different social groups, resulting in the *Social Vulnerability Index* (SVI). The SVI's indicators were also organised into three sub-indices: urban infrastructure, human capital, and income and labour. The purpose of this effort was to systematise qualified information for the design and implementation of public policies, especially those necessary for improving living conditions and overcoming social inequalities.

There is a strong interaction between the MHDI and the SVI projects, but the latter is a more detailed index, with a larger composition of indicators. The SVI expands the possibilities of analysing different variables that determine people's living conditions. Thus while the MHDI highlights the availability of resources and the conditions for people to achieve a minimum level of well-being, the SVI flags the absence, or even inadequacy, of these resources and conditions in the same territory.

The chart given below shows the result of efforts to establish a close dialogue between the SVI and the MHDI. It combines a larger number of indicators that could deepen the outlook on well-being, development and on the capacities of individuals and families to overcome their social vulnerabilities. The methodological process to choose and create indicators, as well as the definition of components, involved a set of correlation tests between the broader set of indicators, and their results. This, among other considerations, lead to the final decision of SVI's set of indicators.

The creation process, for both the MHDI and SVI indicators, consists of an important innovation: combining raw variables (answers to census questionnaires) with more precise indicators about living conditions, work, and housing. Another innovation undertaken in these projects was the creation of small units of analysis within metropolitan municipalities, denominated as Human Development Units (HDUs).

The HDUs were created in the municipalities of Brazil's 20 major metropolitan areas. A homogeneous group of households are gathered inside each HDU. The socio-economic conditions and the spatial constructive standards – determined with the help of satellite imagery – of the households determines this homogeneity. The HDU is meant to better capture the diverse human development situation and social vulnerabilities that occur within the intra-metropolitan spaces, allowing to uncover what is hidden by the aggregate municipal averages.

The HDU, as a new analytical tool, had to be easily identifiable for users – researchers, public servants or civil society members - of online platforms. For this, the project required invaluable technical support from the institutional partners from many states of the country. Those partners revised, proposed, and validated the configuration of these intra-metropolitan spaces, attributing easily identifiable names to each HDU. This was achieved through the combination of the official administrative division of municipalities and the usual popular names of these areas.

This task was crucial for assigning territorial and symbolic identity to the HDU. Once this

Chart 1: Correlation between MHDI's and SVI's Dimensions

MHDI		SVI	
Dimensions	Indicators	Dimensions	Indicators
Longevity	Life expectancy at birth	**Urban Infrastruture**	% of the people in domiciles served with inadequate water and sewage services supply
			% of the population in domiciles with no waste collection
			% of vulnerable people, who take more than one hour to get to the workplace in comparison with the employed population
Education	% of the population aged 18 or older, who graduated from elementary school	**Human Capital**	Infant mortality (from birth till one year of age)
	% of the population aged five to six years attending school		% of children aged zero to five years not attending school
			% of children aged six to 14 years not attending school
	% of the population aged 11 to 13 years, who are in the final years of the regular serial elementary school or have graduated from elementary school		% of women aged 10 to 17 years, who had children
			% of mothers, who are heads of families, with no elementary school education and with minor children, against the total of mothers, who are heads of families
			Illiteracy rate – 15 years or older
	% aged 15 to 17 years, who graduated from elementary school		% of children in domiciles with no one who graduated from elementary school
	% aged 18 to 20 years, who graduated from secondary school		% of people aged 15 to 24 years that neither study nor work, and are vulnerable among the population of this age group

MHDI		SVI	
Income	Per capita income (R$)	Income and Labour	% of people with household per capita income equal or under half a minimum wage (2010)
			Employment rate among 18 years or older
			% of people aged 18 or older with incomplete elementary education and in informal jobs
			% of vulnerable persons and dependents from aged individuals
			Employment rate among 10 to 14 years old

Source: Author's own.

was done, the users had a greater sense of ownership of these areas and their indicators, and were consequently able to create their own readings, diagnostics, evaluation and propositions to their cities and neighbourhoods.

To publish these indices and other indicators in municipal and intra-metropolitan scales, IPEA's researchers and partners decided on the development of two technological platforms: Human Development Atlas (HDA) and Social Vulnerability Atlas (SVA). The platforms unite query tools, analysis and data download, all modeled for different user profiles. This has made municipal and metropolitan information more democratically accessible, and strengthened local capacities, improved public management and empowered common citizens.

The platforms seek to attend to the most diverse actors that operate and live within urban and social dynamics. This is a concise way to identify areas in need of specific programmes and actions, along with sectoral and territorial policies. The platforms support the diagnosis of the various challenges through comparative analyses between territorialities and temporalities (evolution of indicators over the years). Moreover, both technological platforms allow access to clear and concise information, facilitating greater social involvement and participation. Consequently, the main users of these platforms are government managers, municipal players, researchers, civil society, the private sector, and common citizens.

More complex structures are available, from within these platforms, to make compositions of tabs and maps by multiple selections of territorialities, temporalities, and variables of interest. It is also possible to consult a complete dossier about each territoriality, through 'Profile' consultation. The following images illustrate the available queries formats on HDA and SVA.

Image 1: Variables and Territorialities Selection to Tabs Extraction on SVA

Image 2: Variables and Territorialities Selection to Maps Confection and Visualisation on SVA

Image 3: Profile of Territorialities on HDA
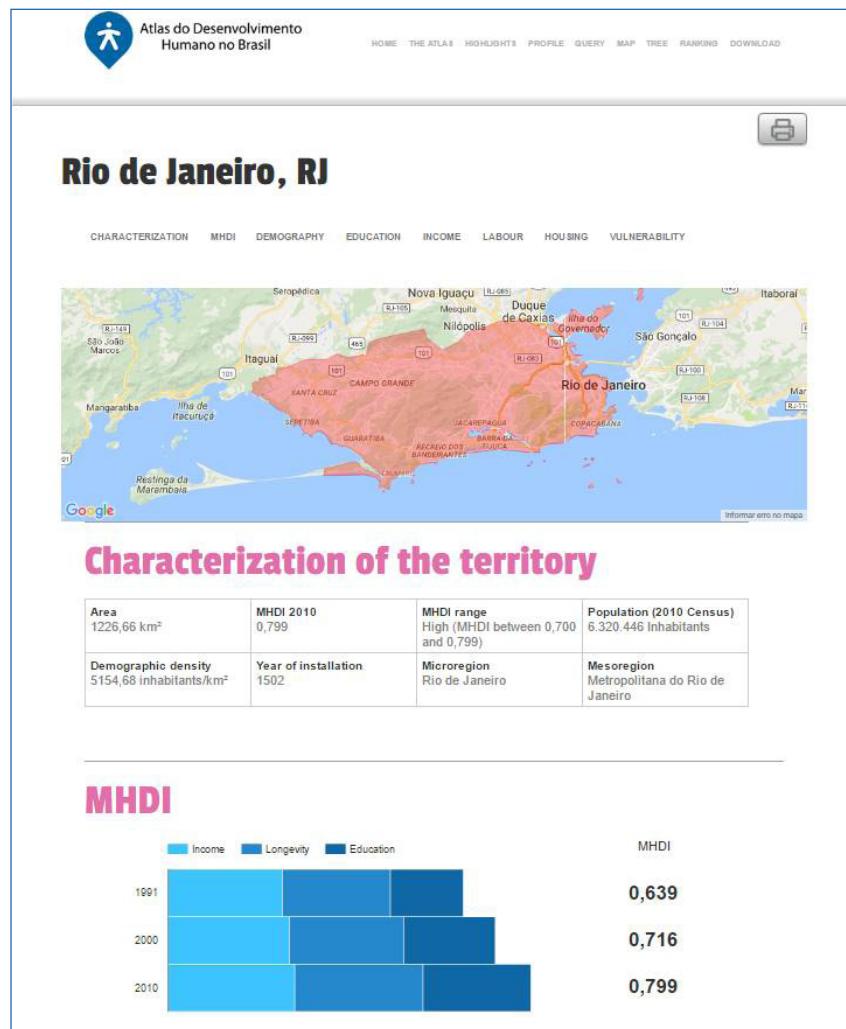
'Participa.br' Platform and the Participatory Preparation of the National Report for the Conference Habitat III

Understanding that the urban challenge requires engagement of all levels of government and society, as well as partnership between them, Brazil adopted a broad participatory process to prepare for its participation in the *Third United Nations Conference on Housing and Sustainable Urban Development* (Habitat III) in a broad participative process, looking for a "more equalitarian, economically and environmentally sustainable society."[3]

One of IPEA's institutional missions is to provide advisory services to the Government of Brazil. In preparation for the Habitat III Conference, IPEA has acted as the rapporteur of the inter-ministerial working group, established by the National Council of Cities. In that capacity, it has contributed to the implementation of a long-term process and to the creation of a virtual

tool hosted on an online platform, *'Participa.br.'*[4] This platform enhanced social participation, by public consultations and discussions of public policy, throughout the preparation of the National Report for Habitat III.

Three activities carried out within this platform need to be highlighted. The first is the public consultation, a public survey based on UN thematic guidelines through a questionnaire that highlighted the public perceptions about the proposed topics for the National Report, and their importance in the daily lives of the people. The second activity was the discussion of the quantitative and qualitative indicators used in the National Report. The third activity was the development of an archive. The platform was configured as a place, where users had the opportunity to submit documents related to the themes of the Habitat III.[5]

In addition to the site - *participa.br/habitat* -the inter-ministerial working groups, as well as other sectors of the society, participated in the *National Seminar Habitat III Participa BR*. The themes discussed during this seminar provided the basis for the construction of the final National Report, with the active coordination of IPEA. The final document[6] was approved by the working group on 21 August 2015, followed by the approval of National Council of Cities on 17 September 2015.[7]

Final Considerations

The two technological platforms created for the provision of socio-economic data on intra-municipal level was a great value addition for the entire list of users for whom the platforms were idealised. With more than 15 million hits, since 2013, both the HDA and SVI Platforms have promoted the integration of available data and policy, allowing all levels of users to understand, in greater depth, the social context in which they live. Through the platforms, it is possible to refine the analysis of certain phenomena, failures and shortcomings. It is also possible to formulate recommendations – with thematic, territorial and temporal precision – to address the many challenges that face cities and metropolitan areas in Brazil, marked by a large socio-spatial inequality.

The *Sustainable Development Goals* (SDGs) have been demonstrating an important role when moving institutions, governments, citizens and the private sector in improving the methods to create indicators to monitor each one of the SDGs' targets on regional and local scales. It is possible to envision a lot of new indicators – about environment, urban, social, economic and other issues – in the future, capable of measuring annual developments related to the construction of more socially equitable and sustainable cities.

In this respect, the development of user-friendly tools that improve access to this range of information is essential. In these virtual spaces, people should be able to find answers to specific questions. The creation of these technologies and their availability to the society allows the expansion of democratic spaces and practices. Thus, these technologies are promoting the extension, or rise in some cases, of inclusive and participatory governance, since better access to data provides the common citizenry to engage with the decision-making process.

The transparency of and easy access to data can ensure greater support for social demands directed at governments and, likewise, allows the governments (national, state or municipal) to

identify weaknesses in each territory more accurately, enhancing their ability to design public policies and undertake actions to overcome these challenges.

Endnotes

1   The concept of 'human development,' as well as its measurement, the Human Development Index (HDI), were presented in 1990 in the first Human Development Report by the United Nations Development Programme (UNDP), idealised by the Pakistani economist Mahbub ul Haq, with the help of economist Amartya Sen. The popularisation of the human development approach came with the creation and adoption of the HDI as the measure of the degree of human development in a country, an alternative to the Gross Domestic Product (GDP), used up to that time as the measure of development. For more, see: "Human Development Atlas in Brazil." http://www.atlasbrasil.org.br/2013/en/.

2   "Human Development Atlas in Brazil," n.1.

3   IPEA. "Boletim regional, urbano e ambiental. Diretoria de Estudos e Políticas Regionais," *Urbanas e Ambientais*, 15 July 2016.

4   "Participa.br," http://www.participa.br/habitat.

5   IPEA, n.3.

6   IPEA. *Federal Republic of Brazil National Report for Habitat III*. Brasilia: ConCidades IPEA, 2016. http://www.ipea.gov.br/portal/images/stories/PDFs/livros/livros/160413_report_habitat_iii.pdf.

7   IPEA, n.3

8

Governance for Smart Cities: A Spatially-bounded Economic Agent-based Lab (SEAL) to Foster Urban Analysis and Policy Evaluation

– BERNARDO ALVES FURTADO,
ISAQUE DANIEL ROCHA EBERHARDT AND ALEXANDRE MESSA –

Introduction

This paper discusses the role of technology in assessing the urban demographic and using Big Data to craft policy solutions for urban governance. Governance of cities is a complex matter.[1] After all, it involves heterogeneous citizens and interests, a number of institutions and values, firms of all sizes and shapes. These interactions happen over space in time, conditioned by legislation, politics, administrative boundaries, and the physical environment.

Given this context of multiple actors and multiple interactions that occur dynamically over heterogeneous space, urban governance should no doubt make use of all data available on all actors, their interactions and interests, their location, and if possible, even on their plans. However, beyond collecting and managing such data coherently, good governance may come only when data are organised in such a way that it can make sense and resemble the actual processes and outputs going on in the cities. If such understanding of the city mechanisms can be fully grasped, then policy recommendations and governance come automatically as a result.

Further, smart cities should be able to look into the future. Conversely, cities should do comparatively less diagnostics, and should instead focus on rapid *ex-ante* evaluation of planning and policymaking. That means unfolding policy proposals into the future and weighting likely developments considering the heterogeneity of actors in a dynamic manner. In practice, those responsible for urban governance should have a very good idea of what a policy implementation will look like in the near future, considering actions and reactions from other groups of interest, the environment, and the whole of the urban community.

Complex systems[2] encapsulate this view that cities are the emergent, ever-changing result of interactions among heterogeneous actors.[3] Agent-based modeling (ABM) is the methodology that comprises the theoretical baseline of complex systems. Born from the seminal work of Nobel laureate Thomas Schelling,[4] ABM was first explored at length as a methodological proposal by Epstein and Axtell in their artificial 'Sugarscape' model.[5] In ABM, a computational simulation runs a model in which 'agents' are entities that represent citizens, firms, institutions, governments.

The actions and interactions among agents and their environment are described so that the rules of interactions are clearly stated.[6]

Formally, Epstein and Axtell define ABM as a dynamic, temporally discrete system in which a vector A represents the states of agents in a given moment and vector E represents states of the environment, both subject to a given mapping of transitional rules: ϕ, Ω. The system can be generally described as the following:

$$A^{t+1} = f(A^t, Et/\phi)$$
$$E^{t+1} = g(A^t, Et/\Omega)$$

However, a formal description does not imply that the model has a closed analytical solution. Usually, results can only be obtained through the actual simulation of the rules.[7]

This paper presents an ABM framework (Spatially bounded Economic Agent-based Lab or SEAL) that aims at simulating citizens, firms and government within political-administrative environment boundaries that can be used to evaluate policy proposals *ex-ante* and thus serve as effective governance tools for various levels of government. The model illustrates the case of Brazil, but it has been built in such a way that it may be adapted for other countries by making minor revisions and changing input data.

The framework is a work in progress. Currently, a running simulation is fully functional for 48 metropolitan areas of Brazil, set up with data from the Census of 2000, with the modeler deciding upon a percentage of actual population. A single consumption tax is implemented at this time. All generation of output and statistics is automatic. Four versions of the model can be run automatically:

- a single run;
- a multi-run that generates summarised results and statistics – with the numbers of runs decided by the modeler;
- a sensitivity analysis – in which varying parameters are systematically tried out; and
- an auto-adjust version that chooses a parameter combination that provides optimal results for GDP and GINI coefficients.

This article's section two contains a description of the model, section three presents some of the preliminary and planned applications, and section four discusses the possibilities, advantages and limitations of applying ABM to urban governance and policy evaluation.

The Basic Model: SEAL

SEAL was originally built to investigate collection of taxes and redistribution of public services across municipalities in metropolitan regions.[8] The main reason to investigate public finances in the Brazilian context is that metropolitan areas have a common working pool with daily commuting workers, whereas tax collection and their application is subdivided by municipality. It has been shown that such model of collecting taxes in divided municipalities favours the central

cities, the capitals of the metropolitan areas, to the disadvantage of large, populous neighbouring poor municipalities.[9] Taking advantage of an additive, modular structure typical of ABM, the model has evolved from a case study into an empirical framework – still in progress – that enables multiple analysis.

The framework is built in Python 3.4.4[10] in a full object-oriented-programming (OOP) paradigm. That is in accordance with the theory, allowing agents to be independent and to react individually according to not only their personal states and methods, but also its local, familiar, temporary environment.

Thus, SEAL contains *classes* for citizens, families, firms and governments (of each municipality). SEAL has been empirically adjusted to read official census data from 2000, the beginning of the simulation. That means that population, fertility and mortality rates, Human Development Indices, number of firms, municipalities official boundaries and actual urban areas, proportion of urban inhabitants, are all read from files prior to the start of the simulation. Probabilistically, an initial fraction of a given population for a given metropolis is generated and the simulation is then run. A number of output and statistics are collected on a monthly basis.

The citizens and their collective of families interact with firms, the government and each other in three markets.

There is a *goods market* in which families make consumption decisions on homogenous products across different firms. Families make their decisions based on both prices and distance.

There is a *labour market* in which firms seek qualified workers or workers that live closest, whereas likely employees look for firms who pay higher salaries.

Moreover, given its importance for urban analysis, there is a *real estate market* in which families with higher savings look for homes with better quality. The decision to move (or to sell) depends on the current employment of members of the family. They may either move to better quality, or cash in the money by selling the best house when all members of the family are unemployed.

Governments are responsible for collecting taxes from firms within their own spatial jurisdiction. Taxes are then used to proportionally increase the municipalities' own Quality of Life Index – which is a proxy of available services for citizens in a given municipality. It is made to resemble the Human Development Index (HDI).

Production and commuting happen every day whereas most other activities happen sequentially at the end of every month. In short, the following activities run every month in the following order:[11]

- Process demographics (births, aging and deaths)
- Firms make payments
- Family members consume
- Governments collect taxes
- Governments spend the taxes collected on municipal life quality improvement
- Firms calculate profits and update prices
- Labour market is processed
- Real estate market is processed
- Statistics and output are processed

Given typical ABM procedures,[12] SEAL has a module that makes multiple runs with varying random numbers possible so that a pseudo-significance of the results can be achieved. That is, given the fact that simulations are not deterministic, a single result may be just chance and not fully characterise the development of the model being run (Figure 1).

In a multi-run simulation, results are presented as probabilistic with median, quartiles and frequency percentages (Figure 2). The literature also recommends that a sensitivity analysis should be performed so that the robustness of the model is evaluated with a greater understanding of how a given set of parameters affects the results (Figure 3). Note that such analysis – of changing

Figure 1: Flowchart of General Procedures in SEAL
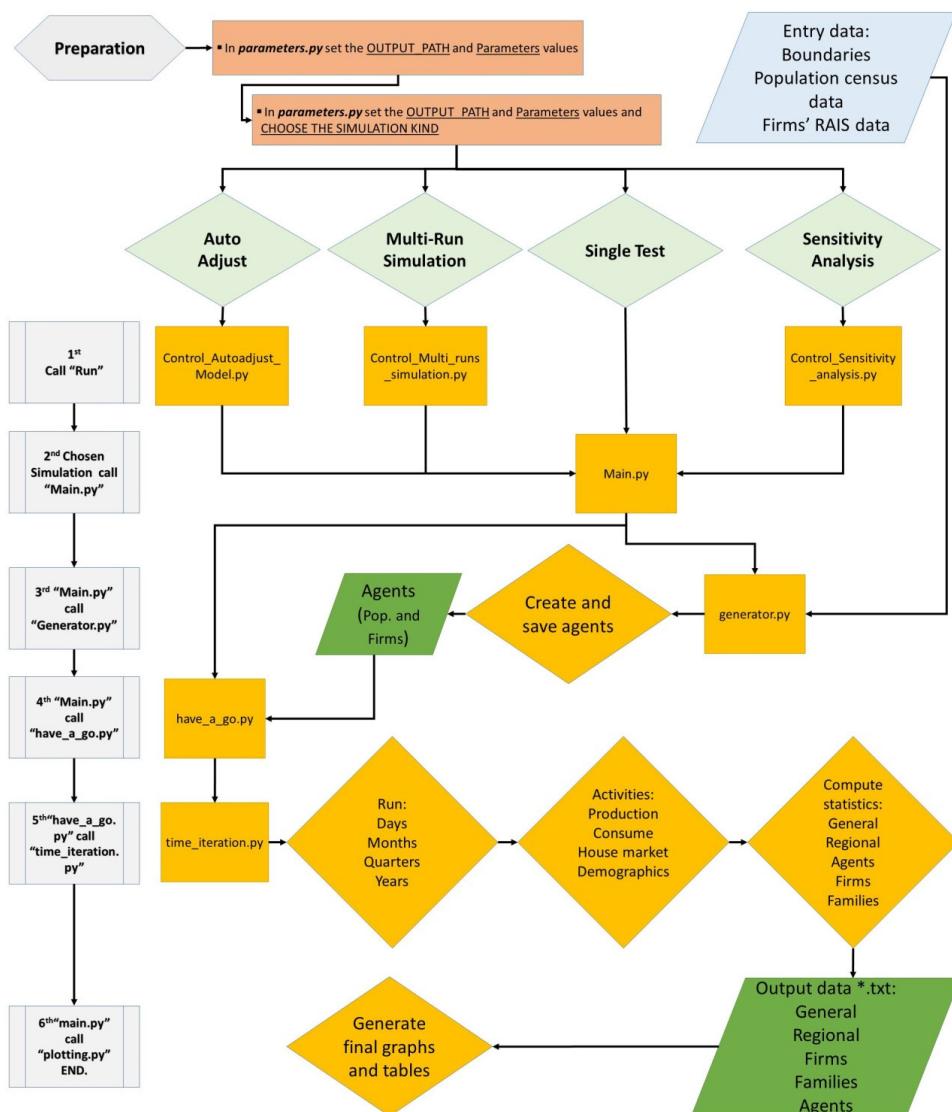
Source.[13]

Figure 2: Illustration of a Multi-run Simulation Result
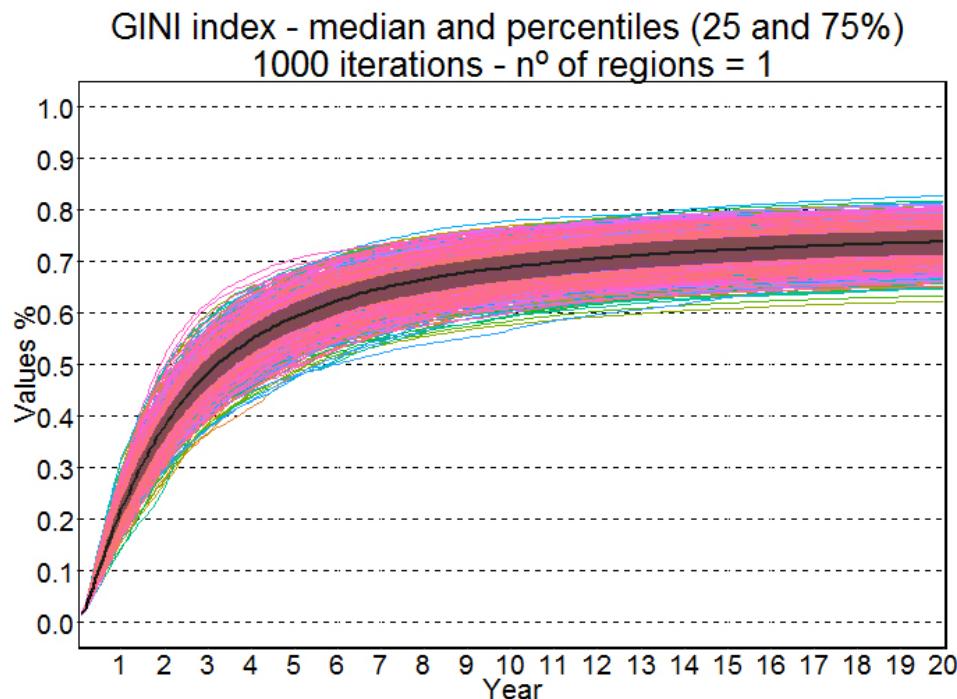
Note: Median value of 1,000 runs in dark, surrounded by quartiles above and below the median.

Source.[14]

parameters and observing the results – is highly instructive in the sense of gaining understanding of changing parameters and the influence of different policymaking.

Policy Applications: Current and Planned

Henceforth, SEAL has been applied as a theoretical preliminary exercise in which the municipalities are merged for tax purposes[16,17] and as a general analysis of the influence of macroeconomic changes into commuting demand.[18] At final stages of production, we have an operating manual[19] thought as "a manual, a reference or a working guide for those wishing to use SEAL as a model, a starting point or a counterpart" and an empirical expansion[20] including a more detailed tax system. However, a number of other policy-oriented analyses and applications that are spatially rigorous could be easily implemented, given SEAL's framework:

- Demographic analysis: changing fertility and/or mortality rates for coming years as well as implementing migration schemes;[21]

Figure 3: Illustration of a Sensitivity Analysis
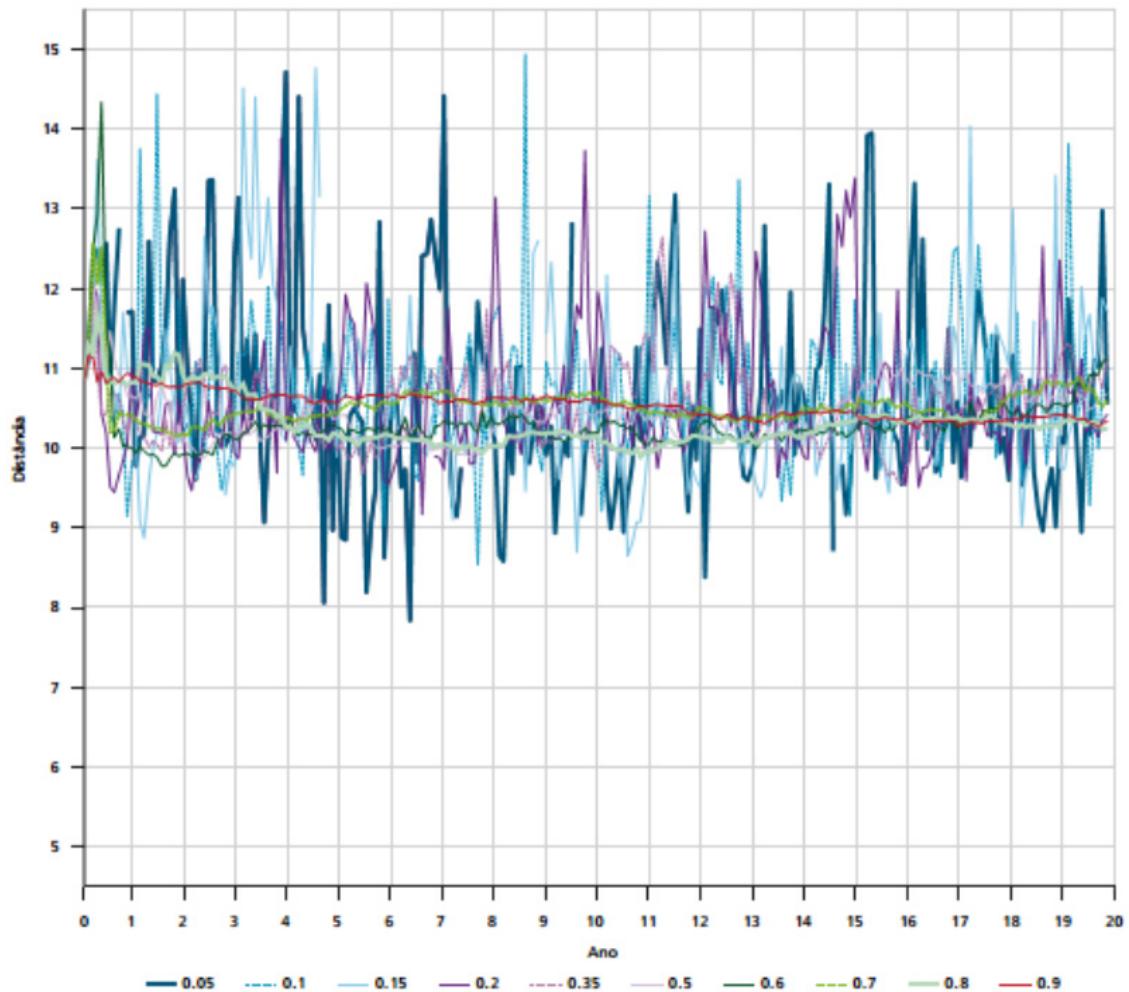
Note: The graph depicts the results of average per capita commuted distance according to different numbers for the parameter of family consumption propensity. Note that commuting distance stabilises when the parameter is 0.5 and above. The smaller the consumption of the families, the less jobs, thus, less commuting.
Source.[15]

- Investment on education: given that agents in the model already have a 'qualification' variable – at the moment fixed throughout the simulation – but that could easily be a result of endogenous increase;
- Transport analysis: adding route possibilities to the current model. Geocoded addresses for firms and households are already implemented;
- Firms' innovation: in which firms could generate more than one homogeneous product. Currently, firms are designed to have an inventory of available products, heretofore containing a single product;

- Urban hierarchy and urban integration with likely urban theory development: using endogenous economic working pools, conditioned to a reasonable daily commuting time.
- Macroeconomic analysis: implementing a credit market (on top of existing 'savings' accounts) and an intermediate sector with firms as well as government as buyers;
- Replace municipalities with regions and investigate countries' interactions across borders;
- A more detailed tax system implementation; and
- Policy-oriented analysis of effects such as: change in commodities prices, creation of regional development funds, urban development of vulnerable areas, among others.

It is relevant to point out that all those analyses would be made while keeping the other modules in place. That is, while a modeler is evaluating a change of a specific tax policy, the outputs in terms of unemployment, level of consumption, activities in the real estate market and time commuting, to name a few, are continuously being computed and reported.[22]

This comprehensive way of urban policy evaluating[23] is considered to be in the scope of what smart cities will need to differentiate their planning from others.'

Key Considerations

This paper makes a presentation of an agent-based model framework (SEAL) and presents its initial and planned applications for policymaking within the complex systems framework. There are some advantages[24] and, similarly, certain limitations in applying such a methodology as a policy tool to empower smart cities governance.

Rapid prototyping and *ex-ante* policy evaluation are one of the first gains for urban governance. Given established previous work, a small team of under six members can provide good insights into the effects of proposed policy within a matter of days. That is, the team can design additional modules and simulations in order to have a better understanding of policy impacts across a number of indicators and specific urban areas before a thought policy is actually implemented. Such rapid prototyping practices may even be tools for real-time, 'what-if' questions and before live meetings in which interested actors may suggest tests or changes to the simulation team.

Another positive factor of an ABM framework is its flexibility. Depending on the interests of governance at hand, different emphasis can be applied to evolve the platform. The fact that the platform is additive and modular means that specific branches can be more (or less) developed than others, while maintaining the full system working in harmony. That enables a more comprehensive approach of policy evaluation when compared to sectorial, isolated analysis.

The kind of approach proposed here also has the advantage of being explicitly spatial, dynamic with an emphasis on individual, local, heterogeneous agents and, more importantly, their interactions. That enables an emphasis of micro-scale rather than working on aggregate measures. All of that is in tune with the description of cities (and their governance, obviously) as complex systems.[25] Further, this proposal includes nonlinear relationships among cause and effects and it allows for tipping points and emergent behaviour,[26] for example.

There are, however, downsides as well. Its high flexibility may also limit benchmarking comparisons, despite the effort to create protocols and rules.[27] Finally, the lack of certainty in

the results – derived from the impossibility of accurately forecasting stochastic future – may not be sufficient to some policymakers used to typical statistics confidence. Overall, governments[28] and institutions alike[29] have started to use simulation and ABM as another contributing tool[30] in helping understand likely future outcomes.

In the context of cooperation among the BRICS nations, the authors of this article would be very much interested in collaboration and further development of the platform.

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9

Drivers of Urban Regeneration and Human Resources in Brazilian Cities

– DANIEL DA MATA –

Introduction

Lack of proper infrastructure and degradation of urban areas are persistent problems in many cities around the world. An approach commonly adopted in the post-war period by cities to tackle these twin issues of inadequate infrastructure and urban decay was to implement urban regeneration programmes. While some cities have been successful in revitalising localised urban areas, others did not achieve such transformation.

Many factors explain why some cities have been more successful than others in implementing regeneration programmes. This paper studies the drivers of urban revitalisation programmes with a focus on the quality of bureaucratic human capital. The author uses data from Brazilian municipalities that have recently promoted regeneration acts to disentangle the drives of urban regeneration programmes.[1] The paper begins by describing the legislation governing (the financing of) regeneration programmes in Brazil. Key data on the drivers of urban revitalisation programmes are then presented, along with the role of local bureaucratic human capital. The Brazilian case illustrates how funding innovations for urban development projects may not be effective, as the lack of human resources does not allow local governments to meet the complexity of non-traditional funding. The results show the disparity between the intention to implement an urban development policy (which raises funds from the private sector but requires high financial expertise) and the actual implementation due to lack of qualification. One important result from this paper is that local governments adopt pro-renewal laws regardless of the qualification of their bureaucracy (and only big-sized municipalities end up executing renewals).

The main idea of a regeneration programme is to improve the quality of housing—after all, the provision of adequate housing is a basic goal of virtually every nation or city. Urban revitalisation programmes are quite heterogenous as an urban regeneration programme can be simply put in place to revitalise a single street or to transform an entire neighbourhood. Some programmes aim solely at housing upgrade; others focus more on providing basic or transportation infrastructure.[2] The quality of a neighbourhood or area is supposedly one of the main criteria to determine whether or not a city will execute a regeneration programme. However, the exact motivation to execute urban programmes may vary depending on the city. Case studies show that the cities which have implemented urban renewal

programmes are those with: (i) a declining city centre and adjacent port areas (decentralisation of population); (ii) emigration of manufacturing firms (manufacturing deconcentration); and (iii) slums (and other forms of inadequate housing).[3] This paper identifies which of these characteristics are more likely to influence the planning of renewal programmes, and examines whether the quality of human resources explains the existence of these programmes.

Section two of this paper presents a brief review of the literature. Section three discusses the urban renewal policy instruments in Brazil, Section four presents data and facts, and the paper concludes with Section five.

Literature Review

In the presence of housing shortage and urban blight, regeneration programmes could *a priori* appear as a reasonable strategy. Regeneration could curtail several forms of negative externalities – such as crime and diseases – that are correlated with inadequate housing. Besides, revitalisation programmes could increase property values and, in turn, raise revenue from local taxes. The government can even incur additional expenses if the programmes deliver social capital benefits to the society.[4] Vigdor[5] found that the price increase stemming from revitalisation is smaller than the willingness-to-pay for neighbourhood quality, and as a result, revitalisation is beneficial for the majority of the population. But the literature also provides some mixed evidence about the impact of urban revitalisation programmes.

First, it is not clear whether the increase in revenues is higher than the government costs of urban renewal programmes.[6] Second, the costs of buying and clearing the land and constructing a new structure might surpass the market value of the newly constructed property, even in the presence of subsidies and other forms of stimuli. Therefore, constructing and selling a housing unit for the former (usually low-income) residents may not trigger the participation of private enterprises in a renewal scheme. As a result, there are many examples of renewal projects which have targeted mostly high-income families, generating segregation. The consequence is that the so-called 'renewal' may in fact only be translating to the relocation of low-income dwellers.[7]

Moreover, urban regeneration programmes can interfere with location decisions and thus generate unintended adverse impacts. In developing countries, where more than one billion people live in slums[8] and where land law enforcement is perceived to be weak, regeneration programmes may even have adverse impacts on slums formation. Programmes that aim at upgrading slums may attract more slum dwellers (from nearby cities or rural areas) wishing to reap future benefits from the reforms. Therefore, instead of reducing slums, renewal programmes can induce their formation within a city. Further, regeneration programmes aiming to boost an abandoned city centre can cause only substitution from one area to another, leading to the decay of another urban area within the same city. Revitalisation programmes with the objective of regenerating industrial districts may even accelerate manufacturing outmigration. To regenerate an industrial district in order to construct new housing units may expel manufacturing firms because they may fear future revitalisation policies.

Historically, the economics literature has given some attention to urban renewal.[9] Those articles aimed at verifying the impacts of revitalisation programmes on household welfare by

analysing how regeneration affects housing prices, externalities, government budgets, and other variables. However, there is little evidence about the objectives and impacts of urban regeneration programmes in developing countries. Lall, Lundberg, and Shalizi[10] is one of the few studies dealing with this topic. They simulate the impact of different forms of government interventions on household welfare, and provide evidence that relocating people to the periphery has negative impacts on household welfare.

Urban Regeneration Programmes in Brazil

Brazil is a highly urbanised country. According to the 2010 Population Census, 84.35 per cent of the Brazilian population lives in urban areas. The Southeast region, the most urbanised region in Brazil, has 93 percent of its population living in urban areas. Urbanisation in Brazil is accompanied by slum growth, urban decay, and a concentration-deconcentration (inverted-U relationship) of manufacturing activity.[11]

The 'City Statute' (Federal Law n. 10,257/2001) is the main legal framework concerning urban policy in Brazil. Its content is vast, ranging from land parceling to the funding of urban development. A relevant part of the City Statute law is reserved for urban revitalisation policies: it defines an Urban Operations (UO) as the main instrument to regenerate a portion of the city. The city must create a local land-use law containing the details of the UO in order to carry out regeneration policies. A UO is basically a partnership between the public sector and developers to regenerate a district of the city. An Urban Operation consists of the following components:

- delimiting an area within the city to be regenerated;
- stipulating a density regulation such as a height limit or a FAR (floor-area-ratio[12]) to limit developments within the delimited area;
- allowing extra development (i.e., additional height or FAR to construct) but only after buying corporate bonds called "CEPAC"[13]; and
- Using the bonds' revenue to regenerate the area.

The manner in which the city finances an Urban Operation varies; one option is the use of corporate bonds. Several municipalities may also use property tax exemption and other forms of incentives to promote regeneration. However, case studies point out that an Urban Operation usually takes place when its financing happens through the use of CEPAC. It is useful to note that the selling of CEPACs are quite complex as it happens through CETIP (a publicly-held company which offers services related to registration, trading, and settlement of assets and securities). Moreover, it is worth noting that an UO entails the construction of housing and/or commercial real estate units, but not of manufacturing plants. The scope of an Urban Operation varies as well, depending on the objectives of the regeneration programmes. The Ministry of Cities in Brazil argues that Urban Operation should be used to combat the decay of central urban areas. Besides, the Ministry of Cities also points out, Urban Operations should be used to mitigate urban sprawl and the trend towards living in the periphery.[14]

Many municipalities have created Urban Operations laws. Examples include the cities of Santo André, São Paulo, and Rio de Janeiro. The city of Santo André (located in the metropolitan region

of São Paulo) has created a regeneration programme to tackle the urban problems associated with manufacturing outmigration.[15] The city of São Paulo has recently used urban operations to fight urban decay. Rio de Janeiro, meanwhile, approved an Urban Operation law to revitalise its port located near the historical city centre.[16]

The next section presents some data facts to understand whether cities are implementing Urban Operation laws to tackle manufacturing decentralisation (as Santo André), urban decay (as São Paulo), and to revitalise port areas (as Rio de Janeiro).

Key Data

In this paper, the main data used for analysis are derived from Brazil's Bureau of Statistics (IBGE). IBGE's Profile of Brazilian Municipalities ('Profile') consists of a questionnaire that all municipalities in Brazil answer annually. The Profile questionnaire changes every year. Therefore, the Profile dataset does not have information on Urban Operations (UO) for every single year. The author uses data on UO for the years 2002, 2005, 2008, 2009, and 2015.[17] The Profile data give information on the existence of UO laws, but not on whether the city has implemented an UO. Therefore, the interpretation of the UO data should be the intention to implement an urban regeneration, but not the actual implementation of an UO.

The Profile dataset also gives useful data on (i) the qualification of municipal civil servants in Brazil; and (ii) the existence of slums and other forms of informal housing. Following Da Mata,[18] this author uses the IBGE's Population Censuses definition of 'informal housing.' Informal housing can be classified as slums, cortiços, or irregular housing. Slums (called 'favelas') lack public services and represent illegal occupation of public land, marginal land (floodplains or hillsides), or land under dispute. 'Cortiços' are high-density slums located in central older parts of metropolitan areas, and 'irregular housing' refers to illegal occupation of land (even if the housing unit possesses all adequate infrastructure).

Data on the potential drivers of large-scale development projects come from different sources. The Profile dataset provide data on two drivers: the age of the municipality, and population size. The Brazilian Ministry of Labour's RAIS (Relação Anual de Informações Sociais) provides information on the mobility of manufacturing plants (the author thus calculates the number of out-migrating plants per municipality). Municipal-level Gross Domestic Product (GDP) data are from IBGE. The FINBRA dataset (from Brazilian Ministry of Finance) is used to obtain data on property taxes. Local infrastructure information – namely, the existence of ports –stem from the Simbrasil dataset. (See Appendix for the list and the descriptive statistics of the main variables used.)

Fact 1: There has been an expansion in the number of municipalities willing to carry out Urban Operations (UO).

Table 1 shows information about UO laws in Brazil. The country has experienced an intense urbanisation process and Brazilian municipalities are currently debating regeneration strategies. In Brazil, the City Statute of 2001 provided general guidance on the creation of local land-use laws. Those local land-use laws show whether an UO is planned or not by the municipality. Table 1 shows an intense growth in the number of municipalities with UO laws. In 2002, 115 cities

Table 1: Number of Municipalities with Urban Operation Law

Urban Operation	2002	2005	2008	2009	2015
Yes	115	393	578	590	1,401
No	5,445	5,171	4,985	4,974	4,168
No answer	1	-	1	1	1
Total	**5,561**	**5,564**	**5,564**	**5,565**	**5,570**

Source: IBGE's Profile of Brazilian Municipalities.

Figure 1: Municipalities with Urban Operation Laws
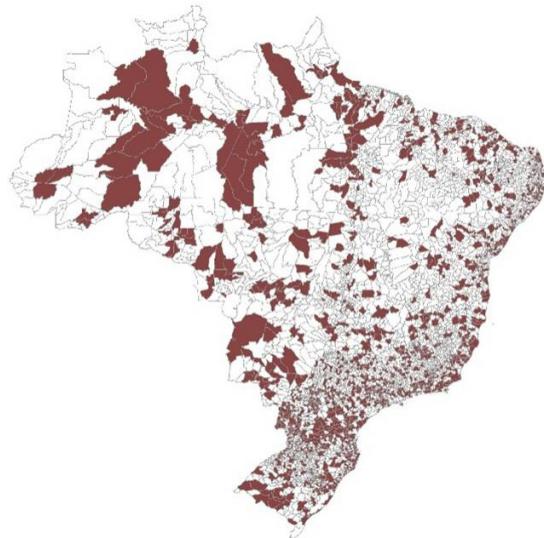
Note: Figure shows the municipalities in Brazil with legislation regarding urban operations in 2015.
Source: IBGE's Profile of Brazilian Municipalities.

(out of the 5,561 Brazilian municipalities) had created land-use laws with urban operations; by 2015, 1,401 cities had created similar land-use laws. Figure 1 shows that municipalities adopting renewal legislation are spread throughout the Brazilian territory.

Fact 2: Even small-size municipalities are increasingly legislating on UO.

Table 2 shows that small-size municipalities are increasingly adopting UO laws. A greater number of medium-size and more populated municipalities have also passed laws on urban renewal. Given the complexity of implementing an Urban Operation (recall Section 3), it is interesting to

see the rise in the number of small-size locations with pieces of legislation regarding UO. Factors such as economies of scale and a minimum value for housing space (i.e., price of a square meter) are relevant when it comes to creating economic feasibility for UO projects, and those factors are basically non-existent in small-size municipalities.

Table 2: Number of Cities with Urban Operation Law by Population Size

City Size	2002	2005	2008	2009	2015
Small city	74	334	486	513	1,187
Medium size	25	46	75	63	180
Big city	16	13	17	14	34
Total	**115**	**393**	**578**	**590**	**1,401**

Source: IBGE's Profile of Brazilian Municipalities.

Fact 3: Places with more qualified civil servants are (slightly) more likely to have UO laws.

In 2014, 26 percent of civil servants in Brazilian municipalities had tertiary degrees, but the variation cross city size is striking (see Table 3). It is noteworthy that answering or not answering the survey question regarding counts and qualification of civil servants can be considered a proxy for lack of human resource capacity. In 2014, 53 out of 5,570 municipalities in Brazil were unable to answer how many civil servants they have. The situation was even worse when the level of education is considered: roughly 10 percent (536 municipalities) were unable to answer the question about the number of civil servants with university degree.

Table 3: Qualification of Civil Servants by Population Size

City Size	% with High School	% with Tertiary Degree
Small city	38.1	23.4
Medium size	36.8	31.6
Big city	30.9	41.9
Total	**37.9**	**26.2**

Source: IBGE's Profile of Brazilian Municipalities.

The author estimates a logit model using the adoption of UO laws as a dependent variable, and the share of civil servants with college degrees as an independent variable. The unit of analysis is a

municipality. The idea is to calculate the probability of adopting a regeneration law given different levels of qualification of civil servants. The results indicate that improving the qualification of civil servants – by increasing the percentage of workers with college degrees from 23.4 percent (average value of small-size municipalities) to 41.9 percent (average value of larger municipalities) – boosts the probability of adopting an UO law by 8.6 percent. In other words, doubling the share of public workers with university degrees raises the likelihood of having an UO piece of legislation (but not drastically).

Fact 4: UO programmes are put in places where there are slums, urban decay, manufacturing decentralisation, and the need for new residential areas.

This author now estimates a reduced-form regression model to verify the correlation between the adoption of urban regeneration laws and selected municipal-level characteristics. Precisely, a logit model is estimated to calculate the probability of adopting a UO law given local characteristics. In the empirical specification, the dependent variable is a dummy for the existence of UO law in 2015 and the explanatory variables are the number of slums, outmigration of manufacturing firms, the age of the municipality (as a proxy for urban decay[19]), and population growth. The explanatory variables are for 2008. The following controls are also used: GDP per capita, property taxes per capita. As in the previous logit estimation of data fact 3, the unit of analysis is a municipality.

Different data sources are employed to investigate the main reasons why cities carry out urban renewal programmes (recall the beginning of Section 4). Endogeneity is an important concern in the empirical exercise. Slums upgrading may be one factor driving regeneration programmes, but revitalisation can attract slum dwellers from nearby cities willing to benefit from future upgrading programmes. Urban decay of the city centre may be another factor explaining regeneration, but revitalisation of one neighbourhood can take place in detriment of the quality of life of another district within the same city (a sort of substitution effect). Idle industrial districts may be a third factor driving regeneration, but manufacturing plants may fear future displacement and may leave the city because of the renewal programme.

Table 4 shows the results from the logit estimation. The potential drivers (determinants) of urban regenerations are positively correlated with adopting an UO law. In other words, it is more likely to find an UO law in places with more slums, decaying urban centres, and manufacturing outmigration. Besides, UO laws are found in places with higher revenues from property taxation (as municipalities may only carry out revitalisation programmes if they have fiscal capacity to bear the financial costs associated with such programmes – recall that some regeneration programmes may depend on tax exemption to be feasible) and in places with greater GDP per capita (as locations with greater GDP may have a faster growing housing market and thus can stimulate renewal programmes knowing that there will be enough demand and constructions).

The results from Table 4 also point out that (after controlling for selected variables) the qualification of civil servants does not seem to affect the probability of adopting UO laws. Places enact UO laws regardless of how qualified their public workers are. This latter result explains why there is a huge gap in the quantity of local governments willing to implement renewal projects (more than 1,000 in 2015) and the number of cities which have actually implemented an UO in Brazil (only few municipalities). Lack of financial expertise from public servants is one relevant factor which inhibits the execution of an UO.

Table 4: Logit Regressions: Drivers of Regeneration

VARIABLES Dep. Variable: Urban Operation Law in 2015	(1)	(2)	(3)	(4)
Slums dummy	0.746***	0.735***	0.749***	0.753***
	(0.0702)	(0.0702)	(0.0707)	(0.0747)
Age of the Municipality	0.0144***	0.0142***	0.0149***	0.0142***
	(0.00170)	(0.00170)	(0.00172)	(0.00179)
Emigration of plants in 1995–2008	0.0215***	0.0187***	0.0166***	0.0165***
	(0.00431)	(0.00428)	(0.00410)	(0.00450)
Property tax per capita 2008		3.413***	2.763***	2.750***
		(1.147)	(0.985)	(1.055)
GDP per capita in 2008			1.66e-05***	1.62e-05***
			(3.99e-06)	(4.20e-06)
% of Civil Servants with Tertiary Degree				0.611*
				(0.369)
% of Civil Servants with High School Degree				0.0517
				(0.305)
Constant	-2.231***	-2.259***	-2.450***	-2.583***
	(0.0884)	(0.0888)	(0.101)	(0.211)
Observations	5,564	5,564	5,564	5,015

Notes: Robust standard errors in parentheses. The regressions are for the more than 5,000 municipalities in Brazil. The independent variables are a dummy for existence of slums in 2008, the age of the municipality, the number of manufacturing firms which have migrated out of the municipality between 1995 and 2008, property tax revenue per capita, GDP per capita in 2008 and education attainment of civil servants.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Source: IBGE's Profile of Brazilian Municipalities.

Conclusion

This paper has shown that urban regeneration programmes are more likely to take place due to city characteristics (e.g., a decayed city centre) than to the qualification of sub-national bureaucratic bodies. This has an important policy implication, as the training of civil servants is required in places with characteristics which are likely to boost the implementation of urban development projects. Improving the quality of the local bureaucracy is even more necessary when the instruments to financing urban infrastructure are complex and require a high level of financial expertise.

An additional exercise would be necessary to understand exact mechanisms explaining why cities carry out renewal programmes. For instance, regeneration programmes may change

incentives regarding location decisions. Renewal programmes would be more present when their net gains are positive. Such positive net gain would happen if:

- The number of slum dwellers which benefit from the programme is greater than the potential migration of poorer households looking for benefiting from future regeneration programmes.
- Jobs created by the regeneration is greater than the future manufacturing job losses (due to anticipation).
- The use of a port is almost null and the revitalisation of port area will bring about positive externalities to the city.
- New housing units generated by the programme is greater than the decay in other areas of the city.
- The city presents a high population growth and there is a need for a new area to absorb its growing housing demand.

Acknowledgements

Appendix
Summary Statistics

Variable	Mean	Std. Dev.	N
Urban operations in 2002	0.021	0.142	5561
Urban operations in 2005	0.071	0.256	5565
Urban operations in 2008	0.104	0.305	5565
Urban operations in 2009	0.106	0.308	5565
Urban operations in 2015	0.251	0.424	5570
# of manufacturing firms immigrating in 2002	0.586	3.608	5565
# of MANUFACTURING firmsimmigrating in 2009	0.656	3.215	5565
# of MANUFACTURING firms out migrating in 2002	0.586	4.982	5565
# of MANUFACTURING firms out migrating in 2009	0.656	4.211	5565
Netmigrationof MANUFACTURING firms in 2002	0	2.028	5565
Netmigrationof MANUFACTURING firms in 2009	0	1.85	5565
Real GDP in 2002 (R$)	207764.964	2386134.95	5561
Real GDP in 2008 (R$)	265589.083	2835414.986	5565
# of MANUFACTURING firms in 2002	44.982	379.517	5561
# of MANUFACTURING firms in 2009	57.076	419.276	5565
# of formal workers in 2002	7309.551	78020.192	5561
# of formal workers in 2009	10905.423	114635.817	5565
Property tax (IPTU) incentive in 1999: yes or no	0.363	0.481	5508
(any) Property tax (IPTU) incentive in 2009: yes or no	0.256	0.436	5565
Existence of at least 1 portin2001	0.008	0.089	5508
Age of the municipality in 2008	44.773	21.717	5565

Source: IBGE and MTE.

Endnotes

1   There are three administrative levels in Brazil: federal government, states, and municipalities. Municipalities are autonomous entities that are able, for instance, to set property and service taxes. They are roughly equivalent to counties in the US. I use the terms municipality, local government and local economy interchangeably.

2   Since I consider the heterogeneity of regeneration programmes, I use the terms regeneration, revitalisation and renewal as synonyms (even though the use of these terms may vary depending on the location being studied or even the type of intervention).

3   Examples of such cities include:

    • Central areas and ports: Buenos Aires (Argentina), Barcelona (Spain), London (UK), Los Angeles (US) and San Diego (US)

    • Industrial areas: Lisbon (Portugal) and Paris-Saint Denis (France)

    • Slums clearance/upgrading: several US cities

4   The literature shows that homeownership and tenure act as economic incentives and influence positively investments in social capital {DiPasquale, D., and E. L. Glaeser. "Incentives and Social Capital: Are Homeowners Better Citizens?" *Journal of Urban Economics* 45 (2) (1999): 354–384}, as well as in human capital via higher school attainment {Aaronson, D. "A Note on the Benefits of Homeownership," *Journal of Urban Economics* 47 (3) (2000): 356–369}. Regeneration programmes may promote homeownership.

5   Vigdor, J. L. "Is Urban Decay Bad? Is Urban Revitalisation Bad Too?" *Journal of Urban Economics* 68 (3) (2010): 277–289.

6   Fisher, R. M. "Public Costs of Urban Renewal," *The Journal of Finance* 17 (2) (1962): 379–386.

7   Nourse, H. O. "The Economics of Urban Renewal." *Land Economics* 42 (1) (1966): 65–74.

8   UN-Habitat. *The challenge of slums: global report on human settlements*, 2003, United Nations Human Settlements Programme. UN-Habitat [and] Earthscan Publications. London: Sterling, VA, 2003.

9   Davis, O. A., and A. B. Whinston. "The Economics of Urban Renewal," *Law and Contemporary Problems* 26 (1) (1961): 105–117; Fisher, R. M., 1962, Op. cit.; Schaaf, A. H. "Public Policies in Urban Renewal: An Economic Analysis of Justifications and Effects," *Land Economics* 40 (1) (1964): 67–78; Stokes, C. J., P. Mintz, and H. VanGelder. "Economic Criteria for Urban Redevelopment," *American Journal of Economics and Sociology* 24 (3) (1965): 249–255; Nourse, H. O., 1966, Op. cit.; Schall, L. D. "Urban Renewal Policy and Economic Efficiency," *The American Economic Review* 66 (4) (1976): 612–628; Collins, W. J., and K. Shester. "The Economic Effects of Slum Clearance and Urban Renewal in the United States," Working Papers 1013, Department of Economics, Vanderbilt University, 2010; Rossi-Hansberg, E., P.D. Sarte, and R. Owens "Housing Externalities," *Journal of Political Economy* 118 (3) (2010): 485–535; Vigdor, J. L., 2010, Op. cit.

10   Lall, S. V., M. K. Lundberg, and Z. Shalizi. "Implications of alternate policies on welfare of slum dwellers: Evidence from Pune, India," *Journal of Urban Economics* 63 (1) (2008): 56–73.

11   Da Mata, D. "Disentangling the Causes of Informal Housing in Brazil: A Quantitative Approach," processed, Department of Economics, University of Cambridge, 2011.

12   Total building area divided by the lot size.

13   A municipality may create a special agency to execute an Urban Operation. This agency may sell bonds and use the money to carry out the regeneration. These corporate bonds are called Certificates of Additional Construction Area (CEPAC, in Portuguese).

14   Ministério das Cidades. Operações urbanas: anais do seminário Brasil-França. Brasília: Ministério das Cidades, 2009.

15   Sakata, M. N. "Novos Instrumentos de Gestão Urbana e Regional: Santo André e o caso do Projeto Eixo Tamanduatei." Pos. 16 (25) (2009): 277–289.

16   Large-scale events may play an important role in urban renewal. Brazil hosted both the 2014 Football World Cup (with several hosting cities) and 2016 Summer Olympic Games (where Rio is the hosting city). Even though the scope of the present analysis does not allow to test the importance of large-scale events, case studies show some association of large events and revitalisation programmes.

17   IBGE. Perfil dos Municípios Brasileiros. Rio de Janeiro, RJ: Instituto Brasileiro de Geografia e Estatística – IBGE, 2002, 2005, 2008, 2009.

18   Da Mata, D., 2011, Op. cit.

19   I use other variables that are associated with urban decay such as existence of "Cortiços," criminality and existence of a port. The results remain unchanged.

10

Financing Smart Cities in India

– V.N. ALOK AND ASHUTOSH VASHIST –

Abstract

Smart cities that have been identified in India are big and different from other cities partially due to the size and high density of population which is relatively heterogeneous in terms of social and economic circumstances. Most of these cities are regional/national hubs for knowledge or pilgrimage and/or economic activities. Thus, fiscal capacities of these cities are greater than that of other cities. But, the capacities of either the municipal or the state government are limited to generate additional resources that are needed for urban renewal or investment in modern infrastructure at international standard. The paper attempts to summarise the policy objectives and developments in the identification of smart cities in India and review the conventional source of revenue of the city administration, i.e., tax and non-tax revenues and intergovernmental transfers including those of Union and state finance commissions. The paper also explores avenues of non-conventional sources of financing for urban infrastructure and improvements in the participatory management capacities of the city administration, which is critical to add value to residents in terms of participation in decision-making and quality services on a sustainable basis.

Introduction

A hundred modern cities enabled with the latest in technology and infrastructure was promised, *inter alia*, by the Bhartiya Janata Party (BJP), a major political party, in its election manifesto launched in April 2014. After a month, the party won the election with a clear majority of its own. The BJP, with the support of other political parties, constituted the National Democratic Alliance (NDA) which formed the government under the leadership of Narendra Modi as prime minister. Soon, the government realised the significance of 'smart city' as an urban development vision that has fascinated various nations across the globe. Consequently, a commitment of 100 smart cities came through the Union Budget 2014-15. Finally, in June 2015, the prime minister formally launched the Smart Cities Mission as a centrally sponsored scheme (CSS) covering 100 cities initially for five years commencing fiscal year 2015-16.

Caragiu and Nijkamp (2009) defined a city as 'smart' when "investment in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic development and a high quality of life, with a wise management of natural resources, through participatory governance." However, in the absence of a precise and universally accepted definition of smart city, the Government of India also admitted under the Smart Cities Mission that there is no way of defining a Smart City as the concept varies from city to city and country to country, depending on the level of development, willingness to change and reform, resources and aspirations of the city residents.

Objectives

In its approach towards Smart Cities Mission, the objective is to drive economic growth and improve the people's quality of life by enabling local area development and harnessing technology that could primarily lead to smart outcomes. The mission promotes cities that could provide the following core infrastructure:

- Physical – green housing, water, sewerage, green energy, efficient public transport
- Social – safety, modern education, healthcare, cultural vibrancy, entertainment
- Institutional – transparency and open data, accountability, ICT and e-governance, residents' involvement in decision-making
- Economic – entrepreneurship and innovation, productivity, employment, local and global interconnectedness.

The core infrastructure include: adequate water supply; assured electricity supply; sanitation, (including solid waste management); efficient urban mobility and public transport; affordable housing (especially for the poor); robust IT connectivity and digitalisation; good governance (especially e-governance and citizen participation); sustainable environment; safety and security of citizens (particularly women, children and the elderly); and health and education.

Strategy

The strategic components of area-based development in the Smart Cities Mission are city improvement (retrofitting), city renewal (redevelopment), and city extension (greenfield development), along with a pan-city initiative in which Smart Solutions are applied covering larger parts of the city. Retrofitting introduces planning in an existing built-up area to achieve smart city and other objectives, to make the existing area more efficient and liveable. Redevelopment effects a replacement of the existing built-up environment and enables co-creation of a new layout with enhanced infrastructure using mixed land use and increased density. Redevelopment envisions an area of more than 50 acres, identified by municipalities in consultation with citizens. Greenfield development introduces most of the Smart Solutions in a previously vacant area (more than 250 acres) using innovative planning, plan financing and plan implementation tools (e.g., land

pooling/land reconstitution) with provision for affordable housing, especially for the poor. Pan-city development envisions the application of selected Smart Solutions to the existing city-wide infrastructure. Application of Smart Solutions will involve the use of technology, information and data, to improve infrastructure and services.[1]

Each city is expected to formulate its own Smart City Proposal (SCP) containing the vision, plan for mobilisation of resources and intended outcomes in terms of infrastructure upgrade by including features mentioned in Box 1 and smart applications.

Box 1: Smart City Features

The mission identifies the following typical features of comprehensive development in Smart Cities:

- Promoting mixed land use in area-based developments–planning for 'unplanned areas' containing a range of compatible activities and land uses close to one another in order to make land use more efficient. The states will enable some flexibility in land use and building by-laws to adapt to change;
- Housing and inclusiveness — expand housing opportunities for all;
- Creating walkable localities — reducing congestion, air pollution and resource depletion, boost local economy, promote interactions and ensure security. The road network is created or refurbished not only for vehicles and public transport, but also for pedestrians and cyclists, and necessary administrative services are offered within walking or cycling distance;
- Preserving and developing open spaces — parks, playgrounds, and recreational spaces in order to enhance the quality of life of citizens, reduce the urban heat effects in areas and generally promote eco-balance;
- Promoting a variety of transport options — Transit Oriented Development (TOD), public transport and last-mile para-transport connectivity;
- Making governance citizen-friendly and cost effective — increase reliance on online services to bring about accountability and transparency, especially using mobile phones to reduce cost of services and providing services without having to go to municipal offices. Form e-groups to listen to people and obtain feedback and use online monitoring of programmes and activities with the aid of cyber tour of worksites;
- Giving an identity to the city based on its main economic activity, such as local cuisine, health, education, arts and craft, culture, sports goods, furniture, hosiery, textile, and dairy;
- Applying Smart Solutions to infrastructure and services in area-based development in order to make them better. For example, making areas less vulnerable to disasters, using fewer resources, and providing cheaper services.

Number of Smart Cities

The total numbers of 100 smart cities have been distributed among the States and Union Territories (UTs) on the basis of equitable criteria. The formula gives equal weightage (50:50) to urban population of the State/UT and the number of statutory towns in the State/UT. Based on this formula, each State/UT will, therefore, have a certain number of potential smart cities, with each State/UT having at least one.

There were 97 cities which, by March 2016, have competed; of them, the top 20 cities of a few States/UTs were selected for funding in the financial year 2015-16. Bhubaneshwar, the capital of Odisha ranked first in the list, followed by Pune of Maharashtra and Jaipur, the capital of Rajasthan. The following are the other cities in the order of their rank:

- Surat
- Kochi
- Ahmedabad
- Jabalpur
- Visakhapatnam
- Solapur
- Davangere
- Indore
- New Delhi
- Coimbatore
- Kakinada
- Belagavi
- Udaipur
- Guwahati
- Chennai
- Ludhiana
- Bhopal

Madhya Pradesh had the maximum number of entries in the list. Ironically, none of the cities from Uttar Pradesh, the largest populated state in India, figured in the list. Similarly, no city was selected from Bihar, another largely populated state. Thus, it can safely be stated that the geographical spread of these cities is not representative of all states and UTs. Special fast-track was provided to the remaining 17 states and six UTs to upgrade their proposals, whose city had not been covered in the list of 20 by the end of March 2016. In addition, 23 cities were requested to submit their proposals by mid-April 2016.

Table 1: Cities allocated to States and their identifications as of 20 September 2016

S. No.	States	No. of Cities Allocated	Smart Cities Identified till 20 Sep. 2016
1	Andhra Pradesh	3	Kakinada, Tirupati, Visakhapatnam
2	Arunachal Pradesh	1	None
3	Assam	1	Guwahati
4	Bihar	3	Bhagalpur
5	Chhattisgarh	2	New -Raipur
6	Goa	1	Panaji
7	Gujarat	6	Ahmedabad, Surat, Vadodara
8	Haryana	2	Faridabad
9	Himachal Pradesh	1	Dharamshala
10	Jammu & Kashmir	1	None
11	Jharkhand	1	Ranchi
12	Karnataka	6	Belagavi, Davangere, Hubali-Dharwad, Managaluru, Tumakuru, Shivamogga
13	Kerala	1	Kochi
14	Madhya Pradesh	7	Bhopal, Gwalior, Jabalpur, Indore, Ujjain
15	Maharashtra	10	Aurangabad, Kalyan-Dombivili, Nagpur, Nashik, Pune, Solapur, Thane
16	Manipur	1	Imphal
17	Meghalaya	1	None
18	Mizoram	1	None
19	Nagaland	1	Kohima
20	Odisha	2	Bhubaneshwar, Rourkela
21	Punjab	3	Amritsar, Ludhiana, Jalandhar
22	Rajasthan	4	Ajmer, Jaipur, Kota, Udaipur
23	Sikkim	1	Namchi
24	Tamil Nadu	12	Chennai, Coimbatore, Madurai, Salem, Thanjavur, Vellore
25	Telangana	2	Warangal

S. No.	States	No. of Cities Allocated	Smart Cities Identified till 20 Sep. 2016
26	Tripura	1	Agartala
27	Uttar Pradesh	13	Agra, Kanpur, Lucknow, Varanasi
28	Uttarakhand	1	None
29	West Bengal	4	New Town-Kolkata
	Union Territories		
1	A & N Islands	1	Port Blair
2	Chandigarh	1	Chandigarh
3	Daman & Diu	1	None
4	Dadra & Nagar Haveli	1	None
5	Delhi	1	New Delhi
6	Lakshadweep	1	None
7	Puducherry	1	None
	Total Cities	**100**	

Source: Ministry of Urban Development, Smart City Mission Statement and Guidelines, 2015.

In the fast-track competition, 13 more cities were included in the first phase of Smart Cities Mission. The updated list of May 2016 includes Lucknow, the capital city of Uttar Pradesh, and Warangal of Telangana. Other cities are Dharamshala of Himachal Pradesh; Chandigarh, a Union Territory; Raipur, the capital of Chattisgarh; New Town Kolkata of West Bengal; Bhagalpur of Bihar; Panaji, capital of Goa; Port Blair, capital of the UT of Andaman & Nicobar Islands; Imphal, the capital of Manipur; Ranchi, the capital of Jharkhand; Agartala, the capital of Tripura; and Faridabad of Haryana.[2]

The third list of 27 new smart cities was announced on 20 September 2016:

• Agra
• Ajmer
• Amritsar
• Aurangabad
• Gwalior
• Hubli-Dharwad
• Jalandhar
• Kalyan-Dombivili
• Kanpur
• Kohima

- Kota
- Madurai
- Mangaluru
- Nagpur
- Namchi
- Nashik
- Rourkela
- Salem
- Shivamogga
- Thane
- Thanjavur
- Tirupati
- Tumakuru
- Ujjain
- Vadodara
- Varanasi
- Vellore

These cities are from 12 states including five from Maharashtra, four each from Tamil Nadu and Karnataka, three from Uttar Pradesh and two each from Punjab and Rajasthan. Five states—namely, Arunachal Pradesh, Jammu & Kashmir, Meghalaya, Mizoram and Uttarakhand—and four UTs—Daman & Diu, Dadra & Nagar Haveli, Lakshadweep and Puducherry—had not entered the implementation phase until the deceleration of the third list (Table 1). The total investment proposed by these 60 cities mentioned in Table 1 is estimated at INR 1.45 trillion.[3]

Financing of Smart Cities

Under the mission, the Union Government gives financial support of INR 480 billion over five years, i.e., on an average, INR 1 billion per city per year. The state and municipality have to contribute an equal amount on a matching basis. However, the project cost of each smart city will vary depending on the level of development model and capacity for execution. It is envisioned, under the mission, that a Special Purpose Vehicle (SPV) is to be created to plan, appraise, approve, release funds, implement, manage, operate, monitor and evaluate the smart city development projects. The SPV, a limited company, is managed by the independent directors, nominees of union and state governments as well as the concerned municipal body. The state/UT and the municipality are the promoters having 50:50 equity shareholdings. The private sector or financial institutions are encouraged for taking equity stake provided the state/UT and municipality together have majority shareholding and control of the SPV.

The shareholders have to ensure a dedicated and substantial revenue stream for the SPV so as to make it self-sustainable and evolve for raising additional recourses from the market. The SPV is required to execute the project through joint ventures, subsidiaries, public–private partnership (PPP), turnkey contracts, among others. Funds provided by the Government of India to the SPV

are conditional and kept in a separate Grant Fund and could be utilised only for the purposes clearly spelt out by Government of India. The initial paid-up capital of the SPV can go up to INR 3.8 billion through the equal contributions of the union and state governments.

The funds provided by the union and state governments as well as the concerned municipality could meet only a part of the project cost. Major funds are expected to be mobilised from the following conventional and non-conventional sources:

Conventional Sources of Finance

Own-source revenues of municipalities: The power of municipalities at all levels, i.e., municipal corporation for larger urban areas; municipal councils for a smaller urban area; and *nagar panchayat* for an area in transition from rural to urban, is considered imperative to enshrine in the Constitution under Article 243 X, to impart certainty, continuity and strength to municipalities. The Legislature of a state may by law authorise the municipality to levy, collect and appropriate certain taxes and user charges. Devolution of these taxes and non-taxes are easily linked with the activities assigned to them, which vary across states. From the long list of matters in the 12th Schedule, certain basic functions could easily be in the exclusive domain of municipalities. Even these essential services require huge funds. Property tax, stamp duty, tolls, tax on professions, tax on advertisements, non-motor vehicle tax, user charges, and the like contribute the maximum to the small kitty of own-source revenue, which form, respectively, 42, six and one percent of total revenue in municipal corporations, municipal councils and nagar panchayats, in 2012-13.[4] In most states, the property tax contributes the maximum revenue. However, this tax remains inelastic because of inefficient administration in its collection.

After own-source revenues, assigned revenues are the most efficient in the dispensation to municipalities. Such revenues are levied and collected by the state government and are passed on to municipalities for their use. Some states deduct collection charges. The practices in assigning revenue are marked by large inter-state variation. However, typical examples of assigned revenue are the surcharge on stamp duty, tax on professions, and entertainment tax. In many states, these taxes form part of the own-source revenue of municipalities.[5]

Financial devolution from states: Proceeds from internal sources contribute an abysmal share to the municipal pool. Municipalities rely more on fiscal transfers from the state government in the form of shared taxes and grants. State taxes are shared according to the recommendations of the State Finance Commission (SFC). Constitution of the SFC at a regular interval of five years is a mandatory requirement for states. Besides tax sharing, the SFC is assigned the task of reviewing the financial position of municipalities and making recommendations on the assignment of various taxes, duties, tolls, fees, and grants-in-aid to be given to municipalities from the consolidated fund of the state.[6]

The most critical function of the SFCs is to determine the fiscal transfer from the state to local governments in the form of revenue-sharing and grants-in-aid. Since the 80th amendment of the Constitution, following the recommendation of the 10th Finance Commission (1995–2000), a certain percentage of all union taxes has been devolved to the states. Many SFCs have also adopted this system for the following reasons: First, the system has a self-policy feature; the

local government automatically shares in the buoyancy of state taxes and levies. Second, the system has built-in transparency, objectivity, and certainty; local governments can anticipate, at the beginning of each fiscal year, their share in the divisible pool. Third, the system enables local governments to understand the entire economy and take considered views to make their own annual budgetary exercise. In other words, it incentivises local governments to generate their own revenue and to mobilise additional resources. Fourth, the state government can be neutral in pursuing tax reforms without considering whether a particular tax is sharable with local governments. This brings the issue related to composition of divisible pool. Wide variations across states are noted in defining the divisible pool and the principle of sharing it among the municipalities.

Union Finance Commission (UFC): So that the SFC does not deter the state legislatures in transferring responsibilities and revenue to the local governments, Article 280 of the Constitution provides that the UFC should suggest measures to augment states' consolidated funds in light of the recommendations of SFCs. So far, five UFCs (the 10th, 11th, 12th, 13th and 14th) have submitted their recommendations. All the commissions except the 13th recommended ad hoc grants to municipalities. The grants of the UFC are generally ordained for operation and maintenance and therefore differ from those of the union ministries. The 14th UFC recommended INR 871 billion to municipalities over a period of five years commenced from the fiscal year 2015-16. In order to enhance the own-source revenues of municipalities, the Commission considered the views of various SFCs and suggested the following[7]:

- Levy of *vacant land tax* can be considered.
- A part of land conversion (e.g., from rural to urban use, and from residential to commercial use) charges can be shared by state governments with municipalities.
- States should prepare a clear framework of rules for the levy of *betterment tax,* by municipalities which do not generally levy this tax.
- States may consider steps to empower municipalities to impose *advertisement tax,* which has two components: tax on hoardings and tax on advertisements on buses, cars, lamp posts and compound walls.
- States should take action to increase the scope of *entertainment tax* so as to cover more and newer forms of entertainment such as boat rides, cable television and internet café.
- Ceiling of *Profession tax* should be raised from INR 2,500 to INR 12,000 per annum by amending Article 276 (2) of the Constitution.
- Municipalities should rationalise their *service charges* so that at least the operation and maintenance costs could be recovered. In our view, automatic indexation to inflation could ensure seamless enhancement over time.
- *Service charges on government properties,* exempted under Article 285 (1) of the Constitution, could be examined in detail so that municipalities could be compensated for the civic services provided by them.

Non-conventional Sources of Finance

Convergence with other urban-sector schemes: Many of the sectoral schemes of the Government of India converge in the goal of Smart city Mission. Notable among them are the following:

a) Atal Mission for Rejuvenation and Urban Transformation (AMRUT), which was launched with the Smart City Mission on 25 June 2015 with the total outlay of INR 500 billion for five years commencing fiscal year 2015-16. Five hundred cities are taken up under AMRUT with an objective of improving basic urban infrastructure including water supply, sewerage and public transport. Cities with a population of 100,000 or above, state capitals and cities in hill states are included in this mission;

b) *Swachh Bharat Abhiyan* (Clean Indian Mission) aims to make India free from open defecation and achieving 100-percent scientific management of municipal solid waste in 4,041 statutory towns/cities across States in the country. The targets set for the mission that have to be achieved by 2 October 2019 are: construction of 10.4 million individual household latrines, 252 thousand community toilet seats and 256 thousand public toilet seats; and achieving 100-percent door-to-door collection and scientific management of municipal solid waste;

c) National Heritage City Development and Augmentation Yojana (HRIDAY) aims to preserve and revitalise the soul and unique character of heritage cities in India. In the first phase, with a total outlay of INR 500 crores fully funded by the central government, 12 cities have been identified for development;

d) *Pradhan Mantri Awas Yojana* – Housing for All (Urban) is being implemented between 2015 and 2022 and provides central assistance to municipalities and other implementing agencies through states/UTs for: (i) rehabilitation of existing slum dwellers using land as a resource through private participation; (ii) credit linked subsidy; (iii) affordable housing in partnership; and (iv) subsidy for beneficiary led individual house construction/enhancement. All these components are being implanted as centrally sponsored schemes except 'credit linked subsidy,' which is treated as central sector scheme.

Borrowing: No reference is made in the Constitution to loans and borrowing by municipalities. Many Municipal Acts in states are silent on the power of municipalities to borrow funds. However, a few Municipal Acts have incorporated the provisions of The Local Authorities Loans Act, 1914 (Act No. IX of 1914) which empowers the municipalities to borrow from the market for certain specified reasons. In the past, municipal corporations have floated bonds in the market, with the approval of their state governments. These include Municipal Corporations of Ahmedabad in Gujarat, Bengaluru in Karnataka, Chennai and Madurai in Tamil Nadu, Hyderabad in Telengana, Nagpur and Nashik in Maharashtra, and Visakhapatnam in Andhra Pradesh. Recently, capital market regulator, the Securities and Exchange Board of India (SEBI) has given boost to the Smart Cities Mission by notifying new norms for listing and trading of municipal bonds on stock exchanges. The move would allow authorities to garner resources for setting up smart cities by raising money from the public and institutional investors. Under the new norms, the municipal authorities are required to have a strong financial track record and such bonds would be listed on stock exchanges. These bonds would be another alternative investment opportunity for

traditional Indian investors who generally invest in gold and fixed deposits. Such bonds would provide reasonable return with less risk, which in turn may accelerate the capital markets.

Under the new SEBI norms, the municipal authorities should not have defaulted in repayment of debt securities or loans obtained from banks or financial institutions, during the last one year. "The corporate municipal entity, its promoter, group company or director, should not have been named in the list of the wilful defaulters published by the Reserve Bank of India or should not have defaulted of payment of interest or repayment of principal amount in respect of debt instruments issued by it to the public, if any," said the SEBI's notification. Further, an issuer should have good rating from at least one credit rating agency before making public issue of debt securities which could only be revenue bonds. These revenue bonds would have a maximum tenure of 30 years. In the process, the issuer has to appoint at least one merchant banker and a monitoring agency such as public financial institution or a scheduled commercial bank to monitor the earmarked revenue in the escrow account.

Pooled Finance Development Fund: Pooled financing is the cooperation between municipalities focusing on infrastructure investments through external debt sources. It does not curtail the decision-making power of individual municipalities and is used as a complement to other sources of funding. The Government of India approved the Pooled Finance Development Fund scheme in 2006. It was initiated for medium-size municipalities where financial expertise is often scarce and which could be generated through cooperation. It could be structured in such a way that it reduces risk for both municipalities and the investors. At the same time, it provides incentives to improve the creditworthiness of municipalities. Tamil Nadu was the first state in India to have set up the Water and Sanitation Pooled Fund (WSPF). Along similar lines, Karnataka also created Karnataka WSPF.

Flexible Public–Private Partnerships (PPP): Under PPP, the private sector is encouraged to mobilise technology, know-how, capital and other resources. This reduces the burden on the government to generate revenue necessary to finance these cities. The Government of India has been promoting PPP since 2006 to achieve self-sufficiency in terms of operational efficiency and service outreach. Moreover, this would improve the financial management capacities of the city management and value to citizens in terms of quality services on a sustainable basis. During PM Modi's visits to various countries, many commitments of PPPs have been received in financing India's smart cities. These investments include technical assistance, capacity building and logistical planning, to allocations for research and development (R&D) and information and communication technology (ICT) services. Further, the Viability Gap Funding (VGF), cleared in 2006, has now been promoted aggressively. Under VGF, a grant is provided to support an infrastructure project which is justified economically but falls short of financial viability due to the project's long gestation period. In January 2016, the Indian government approved the setting up 5,000 MW of grid-connected solar power projects, and over and above the reference price, the companies could bid for VGF from the government. Through such measures, the price of solar power is getting closer to that of conventional power. In order to enhance capacities, the National PPP Capacity Building Programme, initiated in December 2010, is conducted in 16 States. Due to these measures, the dependency on bank credit has been reduced substantially.

Pooled Municipal Debt Obligation (PMDO) facility: Through the participation of several banks, this facility was created in 2006 to finance infrastructure projects in urban areas on shared risk basis. The present corpus of the facility is INR 500 billion, with an extended period to 31 March 2019. This corpus could be leveraged for funding infrastructure projects under the Smart Cities Mission, such as public transport, drinking water, solid waste disposal, and sewerage treatment.

Real Estate Investment Trusts (REITs): The SEBI notified the REITs regulations on 26 September 2014, clearing the way for the introduction of a globally known investment structure in India. REIT is meant for investors who are apprehensive about investing in the physical purchase of real estate property due to the involvement of certain risks. Units of REITs are traded on the stock exchange, contrary to physical purchase of property. These units could be liquidated as and when required. The minimum amount of investment is INR 200,000. This amount is too meager to be invested in real estate of high capital values. It provides stable income to unit holders as 90 percent of the profit is required to be distributed as dividend under REIT which secured exemption from dividend distribution tax (DDT) in the recent Union Budget. Cushman and Wakefield, a real estate consultancy firm, estimates that investment opportunities for REITs are worth INR 3,000 billion. "These structures would reduce the pressure on the banking system while also making available fresh equity. I am confident that these two instruments [PMDO & REIT] would attract long term finance from foreign and domestic sources including the NRIs," said the Finance Minister in his budget speech.

National Investment and Infrastructure Fund (NIIF): In December 2015, the NIIF was registered as category II[8] alternative investment fund (AIF) with SEBI. Initial authorised capital of the fund is set at INR 200 billion and now proposed to be increased to INR 400 billion. The NIIF is a trust which mobilises finance for major infrastructure financing companies, institutions including state entities in India. Funds are available for equity support for Non-Banking Financial Companies (NBFCs) and Financial Institutions (FIs). In the Union Budget 2016-17, an initial allocation of INR 40 billion has been made. Greenfield, Brownfield and stalled projects are eligible for consideration under NIIF.

Assistance from the Asian Development Bank and the World Bank: According to media reports, the Asian Development Bank has agreed to extend US $ 1 billion to smart city projects over the period of 2015–20. Similarly, the World Bank will provide US $ 500 million in long-term loans for the smart city mission. This will be used to provide funds for smart city SPVs.

Conclusion

Smart Cities that have been identified in India so far are big cities which are different from other small cities due to, inter-alia, the following:

- Size of the population
- High degree of concentration of population

- Presence of heterogeneous population in terms of social and economic circumstances
- Regional hubs for people from neighbouring communities, who come to work/shop and use public services
- Presence of international community
- Negative externalities as the cities contribute to environmental damage, from global warming to pollution
- These cities have knowledge-based economy as the prosperity comes from the ability to produce new thinking.
- These cities have greater fiscal capacity than other cities so that they have greater fiscal autonomy, which means bigger responsibilities and greater ability to levy their own tax and non-tax revenues.

The emerging role for smart cities is at odds with Constitutional and legal space in which they are expected to operate. Smart cities are expected to maintain a unified approach to coordination and planning. There is a need for Constitutional recognition of smart city agglomerations and somewhat careful delineation of functions between states and smart cities.

Neither municipal nor state governments have the capacity to invest in urban renewal or investment in modern infrastructure at international standards. Therefore, municipal-Union linkages become necessary. This could be achieved through the constitution of the Metropolitan Planning Committee (MPC). Under Article 243ZE, the Constitution also stipulates a Metropolitan Planning Committee (MPC) to be constituted in a metropolitan area where population is more than one million. Minimum two-thirds of members of the MPC are elected from amongst the elected members of the Municipalities and Chairpersons of Panchayats in the Metropolitan area. The representations of the Indian government and the state government are also prescribed in the Constitution itself. Strengthening and functioning of MPC have been emphasised by many, including commissions and government committees. Prominent among them are the second Administrative Reform Commission (2nd ARC) in its 6th Report on Local Governance in 2007 and the Technical Group on Urban Planning System of the (erstwhile) Planning Commission, 1996.[9]

There is a lot that needs to be done to translate the national policy initiatives into implementation at the city level so that next-generation public services and engagements of residents could be ensured. At the city level, it is of paramount importance to enhance capacities further in basic financial management, accrual accounting, capital investment plans, legal system for revenue and expenditure, so that complex PPP projects could be undertaken seamlessly.

The time will come when these cities will be included in the dialogues and consultations related to inter-governmental relations between the union and states, particularly on national issues including immigration, migration, trade, and environment.

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11

Public Engagement in Governance

– KEDIBONE PHAGO –

Introduction

Urban centres have always formed key parts of advancements in many arenas, particularly technological and economic. With the world now a global village and the proliferation of technological platforms where interactions regarding governance issues are often debated, smart governance becomes compelling to consider. A question to ask is how these social platforms can be customised to advance meaningful public engagements for local governments and their communities. Thus, the primary meaning for smart governance discourse concerning public engagement needs to be associated with an interaction between the government and citizens, based on both parties listening to each other. This is imperative, since developing countries, such as the BRICS (Brazil, Russia, India, China and South Africa) nations, need to bear in mind the level and use of public services—including city libraries, public schools, parks and clinics—in determining the extent to which smart governance can benefit community members. Using these public services could also serve to gauge citizens' interest and, therefore, facilitate an increase in the level of public engagement for citizens on governance affairs in their local governments.

This paper discusses the notion of governance to provide an understanding of the concept and to highlight background issues for consideration. A possible model for smart governance is also described, delineating some of the possible approaches that are user-friendly for local communities.

The Governance Concept

The concept of governance has recently gained traction in the Global South, where the BRICS countries are located. Good governance is necessary for ensuring that meaningful development and growth are measured by their ability to create employment and reduce poverty and societal inequality. While governance matters have always been a part of societal discourse at various levels, they received renewed focus in the 1980s and early 1990s. The World Bank considered governance as one of the key conditions for the Structural Adjustment Programmes (SAPs) it prescribed to borrowing nations. In the developing countries, SAPs were mainly intended to

support economic growth and ensure that these nations implemented socio-economic measures to sustain themselves. Santiso[1] concurs that the World Bank considered SAPs as 'governance conditionality' while the IMF referred to them as 'structural conditionality,' because they provided loans and aid to countries. Providing funding to countries and ensuring an environment that enables implementation of SAP objectives raises the significant question of governance.

Maldonado's[2] work on good governance reminds us that an earlier consideration from the World Bank set up conditions for its loans that were premised on public sector management, accountability, a legal framework for development, and transparency. Similarly, some scholars in developing countries have criticised this governance funding model and approach as neo-liberal and consider it a new form of dominance from which formerly colonised countries have often failed to extricate themselves.[3] In other words, the way issues of governance are understood in most developing countries are within the framework of their former colonial empires. In his article, Pollit[4] discusses the "...inconvenient truths for Anglosphere public administration." He argues:

"Generic management ideas minimise the need for expensive, time consuming local research and the struggle to understand the finer detail of local contexts – because basically the solutions are well known. Rather, like pre-fabricated, they save time and money compared with traditional craft-intensive constructions. Governments export their own (alleged) successes to other countries – especially, but not exclusively, to ex-colonies or to countries that are politically or economically dependent on them."

This argument is revealing and is of special significance to developing countries, particularly in cases where technology and the internet are used for smart governance by engaging meaningfully with local citizens. To firmly maintain a stand to sponsor specific local initiatives and solutions, investments or developments in local contextual issues need to be advanced. While assessing the meanings and values regarding technology, governance and development is admittedly complex even with poor access to education for citizens, it is crucial that developing countries put measures in place to understand these issues (of meanings and values on technology, governance and development) within their contexts. For example, the BRICS countries need to ensure that targeted investment funding for research activities are channelled to evaluate citizens' positions on issues of governance and general development, especially during the initial years of infrastructure planning and implementing smart governance projects.

A notion of governance is also put forward by Gill,[5] who proposes a meaning in which interactions and state-society relations are maintained in a way that structures and processes support legitimate authority for the provision of services. Gill's notion of governance is significant because in it, the legitimate authority in the context of good governance is expected to maintain high ethical standards and accountability in the usage of public resources.

The current discourse on the question of smart governance further requires a reflection on two key issues, namely, contextual issues and rules of meaningful engagement. These issues are discussed in the following sections.

Contextual Issues

Contextual issues pertaining to the meaning of governance in the developing nations outside western influence need special attention. There are several factors that have often been neglected in the quest to find a contextual meaning of 'smart governance.' As pointed out in the previous section, the World Bank's definition of governance contains strong western contextual parlance that takes into account democratic institutions, accountability, and leadership. While the interpretation of these notions is clearly contextually biased towards western countries, other essential attributes from the developing countries have been ignored because of their lack of relevance to this dominant paradigm, as considered by the World Bank. The assumption that underlies this discourse is that in the developing world, views on democratic institutions, accountability and leadership need to be supplemented by oppressed (or ignored) narratives that are embedded in their local values, community, popular interests and expressions, the medium (such as communication and languages), and even the person facilitating the discourse. To facilitate an effective public engagement for purposes of smart governance, it is necessary to emphasise contextual issues pertinent to the BRICS countries and to facilitate service delivery choices of local citizens through technological tools.

Rules of Meaningful Engagement

Rules of meaningful engagements for the urban poor are a necessary part of discussions related to smart governance. With an increasing number of poor people in urban spaces, the issue at hand is that of urban collectivism through technological platforms and how best to allow more inclusivity in governance matters. Thus, the provision of public service requires that citizens' engagement be prioritised to promote the maintenance of a legitimate political leadership. Without this, urban spaces could become anarchist and deplorable, marred by discontent and protests, which could render these cities unsafe and unattractive to investors. This is because while modern and advanced technology has become an important factor in the developing world, it does not replace the need for human interaction. The key question in this discussion is how best technology can supplement town hall meetings and community gatherings to improve participation of citizens in governance matters.

According to Gill, the notion of participation or engagement serves as one of the pillars of democratic governance. This concept of engagement includes stakeholders or electors in the decision-making processes. Their role should serve to ensure that the ruling elite can obtain useful information to facilitate both accountability and the provision of services. When the ruling elite act in compliance with the needs of the electors, the level of trust is often higher.[6]

In this paper, an attempt is made to explain Gill's understanding of governance. His interpretation suggests that governance itself includes attributes that relate to public engagement of the citizenry. Some of the key attributes relating to public engagement include democracy, accountability and leadership. This is a necessary consideration to be made because governance or smart governance remains a means, and not the end, in improving the socio-economic conditions of the citizens. In this way, meaningful engagements, interactions and participation of citizens

in government affairs require no substitute, especially where these attributes of democracy, accountability and leadership are concerned. The above contextual discussion on governance has sought to provide an understanding of smart governance. A smart governance model attempts to ensure a meaningful public engagement with local stakeholders, which is citizen-centred.

Smart Governance Model for Public Engagement

The notion of smart governance for public engagement seeks to assert the power and value of citizens in their political processes using modern technology, especially through social media platforms. Since the introduction of the concept of smart governance is also linked to the state of Andhra Pradesh in India as one of the leading state institutions in the world, its essence is premised on the question of leveraging Information and Communications Technologies (ICTs) and institutions, and facilitating citizen engagement.[7] Thus, smart governance seeks to ensure that local governments become attractive to skilled individuals and businesses. In this way, local governments can become globally competitive and sustainable in the way they do business and create employment to contribute to their socio-economic development. This is necessary because the processes involved in delivering public services need to be accountable and transparent.

The 21st century has seen a tremendous increase in ICT infrastructure in developing nations including the BRICS countries, as also seen in the case of India. This technological infrastructure is necessary to keep up with the growing urban population in developing countries and should be geared towards facilitating the use of high-speed internet connections that could further enable governments to introduce e-government portals for citizens' information and service delivery points (e-government platforms). Public services such as health, education, welfare and housing are increasingly employing technology for accessing information and even for service delivery. (See Figure 1)

For further discussion of smart governance and its applicability to the BRICS countries, the following interlinked considerations need to be made, namely, modelling public engagement for a specific local context, access to technological tools, the costs (setting, maintaining and using), and managing information (overload).

Modelling Public Engagement for Smart Cities

Gill discusses public engagement as one of the pillars for democratic governance, which involves key stakeholders and electorates, where lines of accountability are determined. There are many models around the world that have set out to conceptualise public engagement within a public governance paradigm. In countries considered to be democratic, the question of engagement must be embedded in its governance conditions and often serves as a primary requirement in the manner in which citizen and state relations are undertaken. For example, the promulgation of all laws (for different spheres and levels of government) serve this example of a locally relevant model of public engagement in the context of smart governance. In practice, a period is set aside for the public to offer inputs about the proposed laws to ensure adherence to local circumstances.

Smart technology, if used properly, could serve to minimise a top-down approach where the focus is mainly on government-initiated actions rather than value-created projects by both government and citizens.[8] In his response to identifying a model for effective public participation using social media, Bryer[9] has underscored some of the following developments in the use of social media for public engagement:

- Properly installed technological systems and their use ensures a transparent government and greater access to the citizenry.
- Citizens often play a key role in determining their involvement in public-engagement activities. Instructions and the role of citizens can be clearly delineated only with the active involvement of the citizenry themselves (citizen-centred public engagement).
- However, what must be avoided at all costs is the use of these technological tools for unidirectional information sharing instead of genuine interaction with the citizens.

To ensure that the above points are taken into account for a meaningful public engagement, any model being developed needs to factor in some of the following key issues:

- **Access to technology:** Citizens need to have access to relevant technological gadgets, e.g., smartphones. This is critical to the public engagement model for realising smart cities. Some of the determining factors include government's responsibilities to ensure infrastructure provision, strong and functional education system, and employment creation. (See Figure 1 for further consideration regarding smartphone access in different countries).
- **Empowerment programmes:** Deliberate citizens' empowerment programmes, which are necessary to ensure that citizens' participation is wilful and not circumstantial or forced by aspects such as poverty and over-dependence on government, need to be established. These empowerment initiatives should include access to business and employment (opportunities), good education and entrepreneurial support, among others.
- **Identification of key participants:** This process is often complex to undertake and requires that all forms of groups be included in the identification and discussion of societal issues or problems. Citizens must participate not just as individuals but as a collective (civil society groups, community-based organisations, and non-governmental organisations). In this regard, the voices of citizens are strengthened compared to when they participate as individuals. An elite model has often emerged as a key problem area in determining societal issues and their possible solutions. This is also because there is reluctance to take responsibility wherever systems or solutions are seen to be failing.
- **Legitimacy of current government:** Issues of legitimacy are highly volatile, and the notion of a political office term serves to keep a check on this aspect. It is extremely important that the government is considered to be legitimate to ensure that the trust levels among citizens or the affected population is high. Some of the qualities that facilitate trust include responsiveness of government to societal needs and realisation of or access to basic services.

At the centre of the public engagement model is interaction between citizens and government, i.e., citizen–government interaction in which the primary function of the government is to

serve citizens' needs, and not the other way around. Without such a realisation of citizen-centred approach, other non-state actors (such as political parties, powerful and connected individuals, connected businesses) will occupy the space of citizens. This kind of a state of affairs is undesirable and can lead to negative consequences of poor access to information and decisions, where the legitimacy of government is eroded.

Access to Technological Tools

The issue of access and use of technological devices should be considered imperative in facilitating developments and maintaining a country's competitiveness within the global arena. This is complex and needs sophisticated governments and societies to derive and maximise benefits from technology access and use, such that citizens are the ultimate beneficiaries of these developments. For local governments to maintain good participation levels from their citizens even outside the electioneering periods, smart solutions are considered necessary to ensure that principles of accountability and transparency are maintained. This access is also necessary among the growing urban population, where city halls have become smaller in terms of accommodating citizens for participation platforms. In this regard, the need to ensure access to the technological tools, such as smartphones that are able to access internet, is key. The local governments need to ensure the provision of basic infrastructure services for speed and cheaper internet services or free wi-fi. This is essential to ensure that regular feedback for government officials

Figure 1: Access to Smartphones

Global divide on smartphone ownership
Adults who report owning a…

Country	Smartphone	Cellphone but NOT smartphone	No cellphone
Ethiopia	4	44	52
Uganda	4	53	43
Pakistan	11	46	44
Tanzania	11	62	27
Burkina Faso	14	65	21
India	17	61	22
Senegal	19	63	17
Ghana	21	54	25
Indonesia	21	56	23
Philippines	22	48	30
Peru	25	53	22
Kenya	26	56	18
Ukraine	27	64	10
Nigeria	28	62	11
Mexico	35	36	28
Vietnam	35	52	14
South Africa	37	52	10
Japan	39	50	11
Brazil	41	45	15
Poland	41	47	12
Venezuela	45	38	16
Russia	45	51	4
Argentina	48	34	18
France	49	36	15
Jordan	51	47	2
lebanon	52	36	12
Palestter	57	35	8
China	58	38	3
Turkey	59	36	5
Italy	60	34	5
Germany	60	34	6
Malaysia	65	28	7
Chile	65	28	7
Canada	67	16	17
UK	68	23	8
Spain	71	25	4
U.S.A	72	19	9
Israel	74	23	3
Auustralia	77	16	6
South Korea	88	12	0

■ Smartphone   ■ Cellphone but NOT smartphone   ■ No cellphone

Note: Percentages based on total sample.
Source: Spring 2015 Global Attitudes survey. Q71 & Q72
PEW RESEARCH CENTER.

is received to aid informed decision-making processes for city projects. Without such an approach of massifying access to smart technology for public engagement, the notion of public value for citizens could be difficult to realise. This is because access and use of technology in governance is considered necessary to respond to the policy frameworks and for improved citizens' engagement, which has often contributed to developments within the practice and discipline of public affairs. A study undertaken by a research institute, the Pew Research Center, during 2015 reveals interesting observations regarding access to smartphones. Figure 1 provides the survey results (use and access) for citizens owning smartphones. The BRICS countries are included in the survey.

The figure shows the percentage of people with access to smartphones in various countries. This study sheds light on how smart governance within cities could be facilitated with the use of technology. While this study focuses on country-wide figures pertaining to access, it is necessary for cities to frequently conduct similar surveys to strengthen their discussions with communities. Such surveys could not only determine access to and use of smartphones but also ensure that access to internet services and social media platforms are recorded accordingly. In other words, city officials, managers and leaders could also assume responsibilities to be live on these social networks (such as Periscope, Twitter, Facebook) where critical discussions could be facilitated. Obviously, with the current levels of access to smartphones as highlighted above (along with their limitations), it is clear that targeted studies for individual cities need to be made to determine whether smart governance approaches could be effectively supported. Otherwise, local governments could still be required to consider investing in access to internet services for its community members. For example, most metropolitan cities in many parts of the world have started providing free access to wi-fi for their residents. Therefore, local conditions need to be factored in to properly inform policy approaches while choosing a smart governance model.

The Costs of Technology

A deliberate decision to digitalise government processes at various levels is necessary for proper planning and budgeting needed to create an enabling environment. This will support the citizenry, including community initiatives for local economic development, such as small business. Local governments thus face a challenge to ensure that the cost of technology further serves to facilitate access to governance processes on matters relating to the affairs of the city. The cost of technology needs to be brought to affordable levels for citizens to help maintain their roles for meaningful public engagement for local governance, especially in planning, decision-making and evaluations. In this regard, the local government needs to take full responsibility in setting, maintaining and utilising technological tools for their citizens to minimise any forms of exclusion. Exclusion could often create serious tensions between local governments and their citizens.

Managing Information (Overload)

Access to and use of information is the primary reason why smart governance matters are necessary to be taken into account in the context of local government. Bryer suggests four key

elements of engagement in his model for public engagement using social media, namely:

- Adversarial engagement: This is considered to provide an inclusive space for citizens with censorship. Obviously, for governments, such an approach could be considered too risky. However, for maximum efficacy, the model must offer equal platform to all the citizens.
- Civil society: Since civil society groups provide platforms for their own affiliated groups and individuals, this is considered an embedded group for such stakeholders in smart local governance. Therefore, technological tools need to be created to accommodate the needs of such embedded groups that are able to be actively and reliably involved in governance matters relating to their specialisations.
- Information exchange: The government needs to encourage constant and regular updates of development in communicating social issues. This information exchange seeks to support and ensure the involvement of informed citizens in governance affairs of the local government.
- Collaborative engagement: This requires a society empowered enough to participate in the reciprocal engagement on matters of local governance. This is because there is a need to discuss critical issues, and contribute to ideas, conception, and implementation of projects.

To account for the above elements, the local government has a responsibility to ensure that information is made available in both good quality and good quantity. This is necessary to support decision-making and input into the governance discourses through technology. The question of which element should be considered and when, in managing information overload, needs to be tackled, because each of these elements require the right context to be deemed relevant and/or applicable.

Having discussed the notion of smart governance and its applicability (user-friendliness) above, the question of whether town halls are still necessary for hosting participation forums remains key for this paper. Obviously, there have been challenges in the way public engagements were undertaken in these town halls, which have often hindered effective participation of citizens. Therefore, the process of introducing accessible technological tools to support e-governance initiatives and community engagement needs to be expedited in all the different levels and spheres of governments. However, technological tools need not substitute other traditional forms of community participation; they should only serve to supplement and support these existing forms of public engagement.

Conclusion

Smart governance will remain an important part of urban society for generations to come. This is because the proliferation of social media in cities around the world has resulted in an increasing number of individuals owning mobile phones and even smartphones. Local government within the BRICS countries have a responsibility to facilitate their engagements on these social media platforms to keep up with the current global technological explosion. Reluctance or even failure by local governments to increase access and use of technology for public engagement within urban communities should be considered as a betrayal to citizens. Obviously, traditional methods

of town halls need not be replaced, since they offer value in the necessary human interaction that needs to be maintained even within this technological revolution.

This paper considers a possible model for smart governance and other user-friendly public engagement approaches for local communities. It finds that interlinked aspects such as modelling public engagement for a specific local context, access to technological tools, costs (setting, maintaining and using), and managing information (overload) are the necessary ingredients for maintaining a user-friendly approach to public engagements in governance.

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12

Smart City of Moscow: Human and Finance Resource Mobilisation

– ANDREY BELOZEROV –

Moscow, with a population of over 12.5 million, is also a leading city in terms of information technology. In that respect, then, Moscow may be called a 'smart city.' It has the highest levels of Information Technology (IT) penetration, i.e., second place in cellular phone penetration according to a global leader in broadband testing, OOKLA (2015), second place in Wi-Fi network coverage in public areas according to PricewaterhouseCoopers (2015), and second, too, in the level of development of technology solutions and city systems according to PricewaterhouseCoopers (2016). (New York is in first place.)

The Moscow government provides more than 200 public services available online and via mobile: online portal, 10 mobile apps, and 20 SMS AND USSD services.

This paper discusses the two vectors of development—i.e., citizens and finance—of every smart city, and not only Moscow. The first case is of human resource mobilisation in Moscow. The website and mobile app, *"Our city,"* is a unique citizen engagement tool. *"Our city"* collects complaints of citizens and helps handle municipal issues. Citizens submit their complaints online about issues they encounter when accessing municipal services. Since 2012, 1.4 million city problems have been resolved through the portal.

It allows the Moscow government to mobilise citizens to control the social sphere and involve themselves in finding solutions to problems in areas like housing and public utilities. Before the introduction of the *"Our city"* platform in 2012, there were about 300 inspectors working to identify these problems. Today there are more than one million active citizens who use the app to formalise their complaints and corroborate them with photographs. With ordinary citizens engaged in the monitoring of these problems, the city has been able to make savings as there is less need to add personnel. Citizens often prove themselves more loyal to the government in the process of participating in city management.

"Our city," young as it is, has proven itself to be an efficient means for citizens to have control over their government. Users can navigate the interactive map, click on any district and see the list of planned improvements and their status. If the information provided in the website does not reflect the real situation, citizens are encouraged to file a complaint and support such claim with photographs. The website is constantly updated, increasing the spectrum of services that

citizens can monitor.

The portal ensures optimal transparency of municipal activity. It provides live data on current problems with municipal facilities, and improves the efficiency of Moscow's public utilities. Executive authorities process and respond to an online request within eight working days; in contrast, a standard written request is processed within 30 working days. *"Our city"* thus facilitates and improves the interaction between executive authorities and citizens. Users have the ability to notify the city of any problem, monitor the progress of the problem's resolution, and assess the quality of the work. Users can also confirm or refute official responses through an open access mechanism. This constructive dialogue between Muscovites and municipal authorities enables citizens to report violations and illegal placement of facilities, propose additional measures for cartilage improvement, and use other functionalities of the portal.

The following are some key statistics related to the *"Our city"* website and app:

- About 120,000 infrastructure items (houses, courtyards, city roads, among others) are monitored on the site;
- About 1,000,000 users on *gorod.mos.ru*
- About 1,500,000 city problems have so far been resolved.

Moscow's other famous project in human resource mobilisation is *"Active citizen,"* which is an e-referendum system of the Moscow government. Before *"Active citizen"* was launched in 2014, the government invested in social surveys (with about 1,000 respondents) which entailed high costs. With this website and app, on a weekly basis, the Moscow government submits vital issues for the consideration of citizens, and pays nothing for it. *"Active citizen"* (the website and app) already have about 1,500,000 users and about 50,000,000 citizens' opinions have been collected so far. Some examples of e-referendums in Moscow may be mentioned in the following section.

In November 2014, more than 70 percent of voters in a referendum conducted on *"Active citizen,"* chose pink over black, the only other option offered, as the colour of the Kozhukhovskaya line (a planned rapid transit line of Moscow Metro). Four percent of voters offered their own proposals for the new line's colour, including such complex tones as olive, coral and turquoise. Other citizens proposed identifying the line with a pattern instead, such as stripes, spots or checkers. Some 307,000 people voted via *"Active Citizen."*

In November 2015, Muscovites rejected a plan to rename a metro station named after a Bolshevik revolutionary who was involved in the slaying of Russia's last tsar. Fifty-three percent of voters in the online referendum conducted over *"Active Citizen"* chose to preserve the Voikovskaya name for the metro station and nearby transport hubs, compared to 35 percent who supported a change. There were 301,000 people who voted.

The last example is of using human resource. Moscow's official open data portal was launched on 29 January 2013 (www.data.mos.ru). The information posted on the portal comes from a data warehouse, which the Moscow government agencies use in their daily operations.

This ensures the provision of comprehensive, up-to-date and accurate information. Compared with the websites of other cities, the Moscow portal features a diversified structure, with data distributed across 27 categories. Moscow residents can use the website to interact more effectively with the government. Over 70 popular data sets, such as Traffic Violation Statistics, Wi-Fi in

Moscow Parks, and Moscow Gas Stations Dealing in Low-Grade Fuel, to name a few, have been created upon users' requests. The open data portal covers a variety of issues, ranging from the addresses of baby food banks to lists of Moscow fountains and pedestrian underpasses. In all, the portal boasts over 533 data sets. More importantly, over 40 applications with city services have been made by independent developers. The users of the open data portal have access in the table or map format and the specialist companies in the machine-readable format.

For finance resource mobilisation in Moscow, the government has the city video surveillance system, which comprises a network of video cameras and the Single Data Storage and Processing Centre. More than 140,000 cameras cover the transportation system, cultural, sporting and social facilities. Personnel of the municipal services have access to the data via the common portal. As a result, some 70 percent of crimes are identified and solved with the aid of video-surveillance cameras. The lists of cameras are posted on open access, and any citizen who has become a witness of or person involved in the incident can use a video record.

This system is not funded by the Moscow government, but by telecommunications companies which buy and assemble cameras in the city. The Moscow government pays only for video-content for data centers. Needless to say, this system has also meant savings for Moscow.

As Moscow grew to a city with nearly 12.5 million in population, the government has had to determine ways to utilise new and smart technologies to facilitate governance. While these new technologies have resulted in immense benefits to citizens, the city's managers have also had to grapple with issues of financing these projects, given the rising requirements of cost-efficiency and the sheer number of technology-driven schemes to be implemented. In such a situation, public-private partnerships become an ideal option for Moscow, to give its push for growth a boost.

13

Community Policing and Internet Activism in Rio de Janeiro

– RUTE IMANISHI RODRIGUES –

Introduction

This paper discusses the important role of digital media in the relationship between the police and low-income communities, using Rio de Janeiro's Pacifying Police Units (*Unidades de Polícia Pacificadora*, UPPs) as a case study. In this city, the Internet and social media are increasingly being used by residents to report misconduct and police brutality. This paper argues that Internet activism has allowed local people to report on police brutality in favelas and provide evidence that serious human rights violations are happening in these areas. Public security policies in low-income areas should consider mapping violence with a bottom-up approach as a first step to decrease the existing gap between police officers and the residents of such areas.

The importance of Internet activism and local activists to understand the concept of 'smart city' was elaborated by Townsend. Although information technology has helped develop a new urban infrastructure capable of monitoring and computing data through sensors, cameras and other devices all over the city, this kind of equipment reveals only a part of the technological revolution presently unfolding in the cities. The expansion of access to smartphones, along with the widening reach of wireless internet, have developed, in a bottom-up manner, sociability networks and shared tools that serve as avenues for the sharing of people's everyday experiences. This phenomenon has brought in new elements to urban planning and public policymaking. Participating in social processes is as necessary right now for proper urban planning as it was in the past. In the smart cities, this increasingly happens through the use of digital technology, whether through social media or by creating open-source, collaborative tools.[1]

In the last few years, there has been a substantial growth in the use of smartphones in Brazil as a result of increased access among the low-income population. The Internet activism in favelas and low-income neighbourhoods started with locals getting Internet connection in *LAN houses (cybercafés),* and which eventually broadened with the advent of smartphones. While activism springs from different objectives, what stands out is the use of smartphones as a tool of social control on public policies and of digital media as a form of mobilisation around the rights of people who live in poor areas.[2]

Community Policing in Favelas and Low-income Neighbourhoods

Brazil has one of the highest levels of homicides in the world; most victims live in big cities and are dark-skinned, poorly educated young men.[3] Several authors have already demonstrated that a number of homicide cases in the cities are connected to gangs of drug dealers in low-income neighbourhoods and favelas, as well as actions of security forces in suppressing drug dealing.[4] There are cases, however, where the use by police of excessive force is not at all linked to drug dealings.[5]

Decades of violence in public spaces has alienated the police from the residents of poor areas, who fear both unmeasured violence by police officers and retribution by drug dealers. In an effort to address this alienation and win the peoples' support in these neighbourhoods, governors of Brazilian states, who lay down public security policies, started to adopt the practice of community policing.[6] The success of such policies, however, depends hugely on actions to confront the main factors responsible for the gap between police and the people: actions to control police abuse, and actions to protect those who collaborate with the police.

The UPP programme was launched in December 2008 and as of July 2016, 38 UPPs in 264 favelas or low-income communities have been established, covering a population of 1.5 million people.[7] The UPPs enforce strict standards of policing, and their officers must be trained accordingly, "with emphasis in human rights and the doctrine of community policing" (Act 42787/2011). However, the programme does not establish guidelines for UPP police officers to avoid abuse of their position nor does it provide for the creation of community councils or participatory forums.

During the first two years of the programme, there was a decrease in violence in the areas where the UPPs were implemented. Nonetheless, there were cases of police abuse in the form of use of pepper spray and other non-lethal weapons like rubber bullets or electrical shock, and beatings.[8] From December 2010, the programme was extended to some of the biggest complexes of favelas in the city, and consequently the number of armed confrontations between UPP officers and gangs increased. A wave of condemnation followed against the casualties caused by the police, especially from local non-government organisations (NGO). The police gave justifications for these deaths, saying they were a result of "resisting arrest," or were "accidents caused by lost bullets." These claims were contested by the testimonies of residents, who accused the police of brutality. In such cases, local NGOs advised the relatives of the victims to seek the assistance of human rights NGOs or even the public institutions connected to the legislative and judicial powers, like the Human Rights Commission of the Legislative Assembly of Rio de Janeiro or the Rio de Janeiro State Public Defender Office.

Some NGOs organised campaigns to shed light on the basic rights of people in the favelas so as to protect them against police brutality and violations of their rights. Some notable campaigns included "We're All From Maré and We Have Rights," in Complexo da Maré that was organised by the NGO *Redes da Maré* (a local one), in partnership with the NGO *Observatório das Favelas* (a supra-local one) and with NGO Amnesty International. The campaign in Complexo da Maré also pointed to building forums with the participation of the local population in projects of community policing, gathering local leaderships, NGOs representatives and public administrators. It did not work, however, as drug dealers retaliated violently against the local leadership.

An analysis of the areas with UPPs shows that the residents report police brutality, but not the drug menace itself, out of fear. The threats by drug dealers against the residents, if not addressed, can completely prevent direct interaction between the police and the local community.

Police brutality in Rio de Janeiro's favelas and low-income neighbourhoods was in the spotlight in 2013, during the protests known as "journeys of June." In June 2013 a series of demonstrations throughout the country against the increase in bus fares mobilised hundreds of thousands of protestors. The mobilisations happened mainly through digital social media resources such as Facebook and Twitter. In Rio de Janeiro, the demonstrations also called for the end of police brutality.

Bricklayer Amarildo, a resident of the huge favela called Rocinha, became a symbol of the demonstrations in July 2013, when he went missing after being arrested by police officers from the Rocinha UPP. The question, "Where's Amarildo?," asked by a group of human rights NGOs to promote the cause, became the slogan of the campaign. It went viral through social media, leading to official investigations and gaining wide media coverage.

Following the June 2013 protests, campaigns against UPP officers' brutality were no longer confined to favelas and low-income neighbourhoods, and groups of human rights activists, but became an issue of intense public debate in the city and throughout the country.

Internet Activism: From Favelas to the City

This section will highlight how information technology has helped in constructing, in a bottom-up manner, a network to disseminate peoples' stories, especially of those who live in poor areas. It will also explore how it has helped in changing the existing situation.

Internet activism in Complexo do Alemão, and elsewhere, developed a local network for communication, creating a space in the public sphere for highlighting people from favelas as rights-holders. It has also helped in breaking stereotypes of favela residents as "outlaws" and "scoundrels" and showed them as ordinary people.[9] Specifically regarding public security, this network is also a means to mobilise the residents against police brutality.

In a study on "media activism in favelas," Custódio analyses the relations between the NGOs and groups of Internet activists in Rio de Janeiro favelas. He has shown that the first group works as a means of formation, socialisation and approximation of groups of young people to other groups and social extracts, developing critical abilities on social topics and practical abilities, notably in the communication area.

In Complexo do Alemão, Internet activism has grown by means of collective media, that is, digital news and the like, as well as through *media ctivism* collectives. While the first works as traditional communication tools (although focusing on local issues), the second acts more clearly in terms of political militancy.[10] There are three groups that operate in Complexo do Alemão, which are responsible for highlighting the incidents of human rights violations through social media. The three groups have their origins in traditional activism in favelas, which includes neighbourhood associations, NGO social projects and student unions. After some time these groups specialised in digital communication.

The "Jornal do Alemão Notícias" was created as a blog by journalist Viviane Ribeiro in 2010

and in 2013 it was setup as a Facebook page. Viviane was born in Complexo do Alemão, where she still lives, and has worked as a communications director of the neighbourhood association of her favela. This page publishes on subjects that are of the community's interest, including job offers, information about missing people, social projects, local entrepreneurs' publicity and very often reports of human rights violations, besides news on rights and politics. This page, which now serves as a digital newspaper, has about 12,000 daily readers and is one of the main sources of information on the conflicts that happen in Complexo's favelas. The "Jornal do Alemão Notícias" works basically as a collaborative page, sharing messages from residents, collectives and NGOs and, thus, centralising the information produced by local social media.[11]

The second group is the collective "PapoReto," formed by a group of Complexo's young residents, who had already taken part in social projects, mainly those that offered formation in communications and journalism. This group is known for its role in reporting police brutality through filming, audio recording and photographing – and their subsequent dissemination – such violent incidents in the streets and lanes of poor neighbourhoods. PapoReto has connections with other supra-local internet activism groups, as well as local and foreign NGOs that deal with human rights and subjects related to the favelas. The collective has Facebook, Instagram and Twitter accounts.[12]

The third group is called "Voz da Comunidade," and it maintains a website as well as Twitter and Facebook accounts. This group was formed after the military police occupation of the Complexo do Alemão in 2010, when its main director, Renê Silva, who was then only 16 years old, turned into the main source of information for local and foreign journalists as he used Twitter to break the news from inside the favelas. Renê, who studied in Morro do Adeus, started writing for the school newspaper when he was 11 years old. From 2010, Renê got support, even from big communication corporations, to launch the newspaper "Voz da Comunidade." Its website covers the everyday problems of local favelas, such as lack of basic sanitation, deficiencies in urban services, good practice of local entrepreneurship and violence in favelas, keeping a section in its website to count the number of casualties in Complexo do Alemão.[13]

The neighbourhood associations, NGOs and schools to which these three groups are connected had an essential role in the peace campaigns that happened in Complexo when the project of 'pacification' started to deviate from the goal of getting the police closer to the community. Towards the end of 2012, only after a few months of the installation of UPPs in Complexo, confrontations between police officers and dealers resumed. The year 2014 was extremely violent in Complexo with 63 people injured or killed in shootings. Unlike what occurred in the past, innocent people with no ties to drug dealing became collateral damage.

Thereafter, the NGOs and the local collectives started to organise a peace campaign in Complexo. This included parades in the main streets of the favelas, hanging of white sheets in the windows and promoting the campaign "#SOS Complexo do Alemão" on social media networks, like organising "twitaços."[14] The campaign continued till March 2015, when it reached its peak, with about 5,000 people in the parade and an ecumenical act in memory of a 10 year-old-boy, named Eduardo de Jesus, who was shot by a UPP officer while playing in front of his house in one of Complexo's lanes. He was just one of the many innocent victims in five days of armed confrontations in Complexo. In the days after Eduardo's death, the locals mobilised an intense demonstration throughout the favela, and it became extremely popular through social media,

thereby further widening its reach. Eduardo's death and the events that followed it got widespread media coverage and created an impact on the residents of the entire city.

After the walk, with all the attentions on the security problem in Complexo, several governmental and non-governmental institutions at the supra-local and national level met the residents to search for alternative options to deal with the crisis. As a result of such mobilization, the confrontations in Complexo ceased for about two months. Unfortunately, peace did not last long and the confrontations resumed. They continue until today.

At present, the main groups of the Internet media in Complexo do Alemão are part of Amnesty International's project to monitor violence in the city and map the shootings, and the casualties through an open-sourcetool called #Fogocruzado.

Conclusion

The mobilisation of people from favelas against police brutality is being amplified through digital media. Simultaneously, the possibility to register events using smartphones results in a powerful tool of social control against abuse.

As seen in the example of the peace campaign in Complexo do Alemão, such mobilisation could check the behaviour of police officers and draw attention of government administrators to public security problems and foster measures to mediate conflicts. Although this may be an isolated case, the emphasis on the mediation of conflicts should be a basic principle of public security policies in such spaces, since it holds the potential to transform current realities.

Public security policies could also be improved with actions to decrease police brutality. In that sense, a promising experience to be observed is the participation of the residents in the construction of indicators of police brutality through open-source tools such as the app #Fogocruzado. Such tools can be used to orient resources and efforts to mediate conflicts in areas with high instances of death in the hands of police officers and, it is hoped, help bring about peace and security in these cities.

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14

Exploring Security Options for Women in Smart Cities: A Multi-Pronged Approach

– KANCHAN GANDHI –

Introduction

The concept of 'smart city' connotes more than one meaning. From a gender perspective, a smart city should be able to offer safety from physical, mental and sexual violence to its citizens of all genders. Different groups of people have different needs of security at different times of the day. For instance, school-going children need their institutions, parents and other caregivers to ensure their safety in public spaces like schools and playgrounds. Meanwhile, elderly people living alone in big cities often feel dependent on hired caregivers. They are a 'vulnerable' category as far as safety is concerned.

This paper focuses on security options for women, especially those from the working class, those living in slums or on the streets, as they are regarded as the 'most vulnerable' population in the context of cities.[1]

This paper draws heavily from secondary sources, i.e., previous research on urban issues, and discusses the way forward for achieving safer cities for women. The paper also utilises some primary research material from Delhi, to discuss the neglected spaces in the city. Working-class women need to feel safe and secure both while commuting to and from work and at their workplace. Several studies have highlighted the plight of women who work as domestic helpers and factory workers in India.[2,3] Many actors are involved in ensuring gendered safety and security in public spaces, including employers, institution heads, government officials, members of the police-force, families and society as a whole.

At present, there are few legal safeguards—if at all—that are available for women working in the informal sector; they are often subject to abuse from men in the public sphere and from their employers and male co-workers. At the lowest rung of this hierarchy of exploited women are the homeless, many of whom resort to rag-picking or begging for a livelihood. Homeless women are vulnerable to atrocities both from the men on the street and from the police and other government authorities. A series of articles published by *Hindustan Times* in 2016 highlights how women on the streets are vulnerable to sexual abuse by men on the street, drugs, trafficking and violence from the policemen who demand money from these women.[4]

Strengthening the law is one of the important measures to ensure safety for women, both in

private and public spaces. A strict legal framework and its enforcement can lead to a safer society. Singapore's present situation proves that a strict law regime and increased surveillance creates a law-fearing society, leading to low crime rates.[5]

Women suffer violence in both private and public spheres. In India, there are safeguards in place against violence in private spheres, such as the Domestic Violence Act. However, few such safeguards are in place for violence in the public sphere. A landmark case that drew attention to women's safety in India was the December 2012 Nirbhaya rape case, after which the Justice Verma Committee was constituted to strengthen legal safeguards for women's safety in the public sphere. The Committee submitted its report on 23 January 2013. It offered recommendations on laws related to rape, sexual harassment, trafficking, child sexual abuse, medical examination of victims, and reforms in the police institutions as well as the electoral and educational systems.[6]

The report was a step forward towards reforms in India's criminal legislation. However, many of its recommendations were not incorporated while amending the law. This has negatively affected the cause of reducing crimes against women in India. As Yamini observed:[7]

> "The Criminal Law (Amendment) Act, 2013 has been strongly criticised by several human rights and women's rights organisations for not including certain suggestions recommended by the Verma Committee Report like, marital rape, reduction of age of consent, amending Armed Forces (Special Powers) Act so that no sanction is needed for prosecuting an armed force personnel accused of a crime against woman. The Government of India replied that it has not rejected the suggestions fully, but changes can be made after proper discussion."

Statistics show that women are more frequently at the receiving end of sexual crimes across different cities in India. The state-wise scenario of crimes against women differs due to cultural norms and practices. However, most cases of crimes against women are recorded in mega cities. The National Crime Records Bureau presents the following statistics on crime against women:

> "Among 53 cities, Delhi (5,194 cases) has accounted for 14.2% of total such crimes followed by Bengaluru (6.2%) (2,263 cases), Kolkata (5.7%) (2,073 cases), Hyderabad (5.2%) (1,899 cases) and Vijayawada (5.2%) (1,898 cases). The crime rate was significantly higher in Vijayawada, Kota, Kollam, Jaipur and Indore at 256.4, 130.2, 106.3, 98.1 and 88.8 respectively as compared to average (47.8) of mega cities."[8]

These crimes include robbery, chain-snatching, molestation, rape and murder. One of the most frequent sites for such crimes is the public transport system. Women are more susceptible to crime when they are on the move. There have been reported cases of rape of women travelling in cabs operated by private vendors such as Uber and Ola.

Indeed, the safety and security of women is a problem of global dimensions. To address these concerns, the United Nations launched the Safe Cities Global Initiative, in 2010.[9] It includes a flagship programme run in partnership with UN-Habitat, 50 global and local partners and a 'Safe and Sustainable Cities for All' joint programme in 16 cities across the world.

"The overarching aim of the Safe Cities movement is to eliminate all forms of violence against women and girls by challenging deep-set cultural, political, economic and societal drivers that breed and nurture gender inequality, and by empowering and allowing women and girls to make changes within their own communities."[10]

The 'Classed' Nature of Violence against Women

It is now known that not all groups of women are equally susceptible to violence in the city; some are more vulnerable than others—often, working-class women in dangerous settings such as factories or on the streets begging, as well as homeless women. As pointed out by Action Aid:[11]

"While cities and towns contain dangers for both men and women, it is women – and more specifically poor women – who are particularly at risk from attacks due to poor lighting, dark streets, dangerous public transport systems and inadequate policing. The problem is widespread and shocking – of the women interviewed by Action Aid Bangladesh as part of our Safe Cities programme for instance, 87% said they faced harassment in bus terminals and train stations, 80% by the roadside, and 69% outside their schools and colleges."

Security Issues of Working-Class Women and Men: Reviving Neglected Spaces in Cities

This section highlights the problems faced by working-class women, gathered from qualitative primary surveys and interviews. Several studies have already revealed how women from the working class are employed in occupations where conditions are unsafe, they are exposed to the male gaze, and they receive unequal wages.[12, 13] From a class perspective, however, both women and men from the working class are more susceptible to violence in cities.

The two case studies of a female and a male security guard—interviewed by the author at two public locations in Delhi in August 2016 and excerpted below—explore issues surrounding 'classed' violence. Security personnel like these two are hired by government offices from private agencies. However, neither these agencies nor their employers provide them the requisite safeguards.

The author interviewed a Woman Security Guard (WSG) at a subway crossing at Rajeev Chowk, a central part of the capital city. The excerpt below highlights the problems she faces in the public space.

KG: How long have you been working here?
WSG: Around a year.
KG: This seems to be a difficult job.
WSG: It is. Previously, my company had sent many male security guards to work in this subway. They all ran away in 10 days because the drug addicts were harassing them. This place was filthy as hell when I arrived. I have cleaned it up and made it useable.

KG: What about you? Don't the drug addicts trouble you?

WSG: They did initially, but I am risking my life to continue this job. When I first arrived, this subway was filthy. I cleaned it up and fought with the drug addicts who occupied it.

KG: How did you do that? Did your company help you?

WSG: No, the company doesn't provide any help whatsoever. I have fought with them with the help of parking attendants who work here. I call up the police when the drug gang arrives. The police come down soon when I call up and drive them away.

KG: But it is still risky to be here, right?

WSG: Yes, very. But I am doing it for my son who is 14. I lost my husband a few years ago and migrated from the village to the city. My duty hours are long, a 10–11 hours shift. That is why I have left my son with my sister who lives here, since she is a housewife. I live nearby with my younger brother. I am on duty from morning to evening 8pm.

KG: So, you keep standing for so many hours? And where do you go to the toilet?

WSG: Yes, I have to stand. There's no place to sit here. I don't want to sit on the floor like a beggar. There's no toilet in the subway, so I go to the adjoining parking lot to use the toilet.

This woman security guard reported feeling vulnerable in the location of her post. Her company was unapproachable for any of the problems she faced. Her employer (a government office) was also largely non-cooperative in providing her with the basic amenities she needed at work. She told this author that she survives in the job mostly due to her own courage.

The next interview is that of a Male Security Guard (MSG) at the Mehrauli Archaeological Park in South Delhi. The park is under the jurisdiction of both the Archaeological Survey of India and the Delhi Development Authority.

KG: Look at those men jeering at the women visitors! Why don't you do something about it?

MSG: What can I do about it, Ma'am? Their parents could not teach them; how do you expect me to reform them? They are all from the eating and drinking gang [sic]. They are into drugs and alcohol. I am but a poor security guard. If I say anything to them today, they will bring a bigger gang tomorrow and murder me. Every day, a dead body is recovered from this jungle. Defiled bodies of girls have been found here with all the internal organs hanging out. I cannot mess with these men. I am a poor man. I need to preserve my job.

KG: Your company doesn't help you with the safety issue?

MSG: No, there is nobody to help us here. If a policeman came here, they would all run away, but they are not scared of us.

The narratives of both the female and the male security guards bring up important issues related to safety in public spaces. In both the cases, the two respective spaces are neglected by the government authorities as far as safety is concerned. Subways, for instance, are in a state of neglect across all big cities in India. Several newspaper reports have highlighted how these subways are dark, dingy, unsafe, filthy and unusable.[14,15] Any initiative that strives to achieve a safe city must revive neglected spaces such as subways and underutilised open spaces and parks, which have a potential for becoming crime scenes.

The Road to Safer Cities: Multi-Pronged Strategies

Solutions for instituting safety in India's urban spaces are never simple or straightforward. There must be multiplicity in the way planners and policymakers approach these security issues. The following sections discuss some of the strategies that have been examined by academics, activists and practitioners in the field.

1. Urban Design Elements: Addressing Deserted and Neglected Spaces in Cities

Gill Valentine discusses how women in the United Kingdom felt unsafe with some building and landscaping elements:[16]

> "First, large open spaces which are frequently deserted: parks, woodland, waste ground, canals, rivers and countryside. Frequently local place mythologies develop around such places. The Reading findings reflect an association between wooded parks and 'dirty old men' similar to that noted in Burgess's open space project (1987). Secondly, closed spaces with limited exits where men may be concealed and able to attack women out of the visual range of others: subways, alleyways, multistorey car parks and empty railway carriages. Such opportunities for concealed attack are often exacerbated by bad lighting and ill-considered and thoughtless building design and landscaping."

She argues that public spaces can be made safer by ensuring good lighting and visibility. Similar design and landscaping elements can be adopted in other cities across the world to make spaces safe and user-friendly.

2. IT-Based Solutions to Women's Safety

Kalpana Viswanath highlights how several mobile apps were devised after the December 2012 Nirbhaya rape case in Delhi. There is, for instance, the device called *Safetipin*, which can be used to conduct safety audits and ascribe a safety score to different neighbourhoods in the capital. Viswanath explains:[17]

> "At the core of *Safetipin* is the safety audit that measures nine parameters, including lighting, the state of the walk path, as well as the presence of people and specifically women on the streets, the availability of police, public transport and 'eyes on the street.' Each audit appears as a pin on the map and is used to compute the safety score of an area."

While the app has received positive response from some sections of the middle class, its knowledge and awareness is limited to a certain section of the society. As argued above, there is a 'classed' nature to crimes against women, with the poorer or working-class women being more vulnerable.

Indeed, technology-driven interventions are only one part of the solution to the problem of safety. In a country like India, where the digital divide is huge, there must be interventions for the vast majority of people who do not have access to such solutions. People in informal settlements or are homeless in the city remain disconnected and as such will not benefit from such smartphone-based tools. For the women from lower income groups, safe options for mobility in the city and affordable housing options must be developed to make the city safer for them.

3. Integrate Urban and Regional Planning to Address Rural Degradation and Distress Migration to Cities

There is a critical need, now more than ever, to integrate regional and urban planning. With the negative impact of climate change and the changing cropping patterns due to frequent droughts and floods, the population of environmental refugees will only continue to swell. Distress migration from rural areas is leading to congestion in the cities, with more people forced to live in dangerous conditions on the streets. These sites are often marked by violence, and the occurrence of fights, rapes and murders is higher in places where people are living rough and in rage.

4. Affordable Housing for Improved Safety

In the context of the United States, Misra notes that due to affordable housing schemes, the racial composition of some of the neighbourhoods have changed in recent years:[18]

> "The share of black homebuyers in high-minority neighbourhoods, both poor and not-so-poor, decreased. The authors suggest that this might be because other racial and ethnic groups moved in, and concludes that building affordable housing in high-minority areas, therefore, 'may lead to lower racial segregation.' (It's worth emphasising the 'may' in that sentence. A decrease in the share of African Americans doesn't necessarily lessen segregation. In a Hispanic-black neighbourhood, for example, if the fall in the share of black residents is accompanied by a rise in the share of Hispanic residents, the neighbourhood may even become more segregated.) The one other neighbourhood characteristic economists tracked was crime. In poor neighbourhoods, crime rates dropped after development of affordable housing; in richer ones, they didn't really change."

A 2016 study on affordable housing by two Stanford University professors, Rebecca Diamond and Tim McQuade, concluded that the construction of houses with Low Income Housing Tax Credit, which provides funding for the construction of subsidised housing, led to a decrease in crimes and racial segregation in low-income neighbourhoods.[19] In high-income neighbourhoods, the introduction of affordable housing did not lead to an increase in crime. However, new projects in wealthier neighbourhoods drove down home prices and decreased racial diversity.

These findings can be applied to the Indian context. Affordable housing schemes may lead

to the mixing of the lower middle class and poorer households, which may in turn result in the creation of safer neighbourhoods for the poor and the homeless in cities.

5. Localised Solutions to Urban Issues: Towards Inclusivity

SK Das discusses the Challenges for the Habitat III Urban Agenda. He calls for local or place specific urbanisms, since every city has different needs and aspirations.

> "We need a far more serious exploration of place-specific urbanisms that have a deeper link with people at the social, economic, and livelihood level. We are getting global cities but not our unique urbanisms...
> "Alongside this, it must embrace global phenomena of social and cultural diversity. We need to broaden the scope of inclusivity and work towards a shared city. Public spaces should function as a shared territory in which the confrontation of sensibilities, interests and aspirations generates new and specific urbanities. Especially in the developing world, there is a greater need than ever before for every city to reflect its own unique multiplicities. We must broaden the scope of inclusivity. Civil society space must not be driven only by NGOs with external support, but must give a legitimate and rightful place for mass organisations and communities to play that role through strong local democracies that ensure the safety and protection needed for people to participate. Further, cities must not allow powerful interests to recede away from the shared life of the city into gated enclaves, but should work towards fostering the public domain and un-gating the gated."[20]

Indeed, localised solutions should be looked at instead of copy-pasting interventions from the rest of the world. Drugs, human trafficking, prostitution and rape—all need interventions of different kinds. Each city has its unique set of issues. For instance, Delhi is now popularly referred to as the "rape capital" of India. The government and civil society efforts must be actively geared towards ensuring women's safety in the city. More surveillance and monitoring is required in the "risky" and crime-prone zones in Delhi.

6. Sensitising the Police and the Judiciary

Crimes against women in public spaces are on the rise in cities in India. A sensitised and proactive police force can go a long way in making public spaces safe for women. Research has shown that the police is insensitive to poor women, especially homeless women, who are left vulnerable to police atrocities.[21] Police reforms should be implemented so that people's faith in the law and order system in the country is restored. Many women still fear reporting crimes to the police for the fear of being further abused by them.

Currently, there is a huge gap in the number of male and female employees in the police force. A report in *The Hindu*, dated 25 December 2012, reported that there are only 442 all-women police stations in the country. It further stated:[22]

"The ratio of men-women cops in the police force is also dismal. In Delhi, out of 82,000 cops, women comprise just 5,200. However, women rights activists feel that instead of opening women police stations, State Governments should focus on setting up women's cell or desk at each police station so that more and more women can go there freely and report crime being committed against them.

"'We have been demanding that there should be women cops at each police station trained to address the problems of women. A women's desk at each police station will help in checking crime against women. We also need to have more women cops recruited and trained to address their issues,' senior CPI(M) leader Brinda Karat told *The Hindu*.

"Pointing out that today women cops comprise a dismal 3–4 per cent of total police force in India that stands at around 16 lakh, Ms. Karat said the governments need to change recruitment policy. 'Today, women are being taken into police force just to tackle women protesters... there is no focus on improving policing. Things would not change till our police force remains men-dominated and where women fear to approach police stations to report crime against them. Complete overhaul of the police system is the need of the hour,' she asserted."

Another report in *The Hindu* on 6 April 2016 states that the women's police stations do not serve their purpose in Karnataka, since most women officers are even more insensitive than their male counterparts.[23]

The police forces in more developed parts of the world demonstrate promptness and efficiency when it comes to addressing safety concerns in the cities. In the US, for example, the police force has evolved for the better to address citizen concerns. This is explained in a study by Butzer et al. for the National Criminal Justice Reference System:[24]

"Since the turn of the century, police work has changed in the United States, as have the community's expectations of the police. The gunfighter gave way to the billy-club-swinging, dumb-but-strong beat cop, who was in turn replaced by the professional, technology-supported and sometimes arrogant expert in crime. With the influence of community policing, this image of the policeman is now evolving into a cooperative, responsive and respectful community partner. The change is slow, persistent, and on-going. It is reflected most obviously in those officers who work under the philosophy of community policing and in the emergence of specialised areas of enforcement which have evolved from changes in community expectations of law enforcement. The role of the police officer in combating domestic violence is a prime example of this evolution.

"Police agencies attribute the change in law enforcement strategies to a number of factors. Key among these are the efforts to de-politicise and professionalise police forces in the early part of the century. These efforts resulted in the adoption of a military chain of command model for the agencies and in routinising policies and procedures within a Bureaucratic hierarchy which was subject to limited community oversight. While the efforts did much to curb corruption in police work, they also contributed to the separation of the police officer from the community."

Police reforms like those implemented in the developed countries will go a long way in making our police force more sensitive, approachable and efficient.

7. Reducing Inequalities

The wide gap between the lifestyles of the upper, middle and lower classes also leads to frustration and violence. Women in informal settlements live in perpetual deprivation. Studies from slums across India suggest that women in informal settlements are unable to relieve themselves during the day, due to the lack of public toilets.

Chatterjee from Public Radio International (PRI) reports:[25]

> "Some 70 percent of households in India don't have access to toilets, whether in rural areas or urban slums. Roughly 60 per cent of the country's 1.2 billion people still defecate in the open. And the consequences for women are huge.
>
> For girls in rural areas and urban slums, lack of access to clean toilets and sanitation is a big cause of dropping out of school, or not going to school at all. It's the difference between education and independence and being locked into poverty and subjugation."

Women fear molestation and physical assault and have to wait until nightfall to be able to go to urinate and defecate in the bushes and shrubs nearby; they do so only in groups. A large number of slums in the city of Mumbai, where half the population lives in informal settlements, lack basic hygiene and are highly susceptible to flooding and water-borne diseases during monsoon. The 2001 Census listed that 99.9 percent of the slum population in M Ward, the hotspot for poverty in Mumbai, did not have access to electricity, and there was one public tap for every 165 people in that ward. In September 2015, *The Indian Express* reported on a survey conducted by the Tata Institute of Social Sciences, this ward reflects the dismal state of sanitation in slum pockets, where more than 800 people defecate in the open.[26]

For women in the working class, sanitation and health issues are critical. The lack of public toilets for women in most cities comprises a health hazard for women in informal settlements and streets. Urinary tract infections and reproductive health issues are common due to the paucity of toilets. There can be no discourse of "smartness" if a big section of men and women in the city live in deprivation of basic sanitation services.

D'Silva Dias points out that gender insensitivity and not the lack of space or funds is the problem in building toilets for women. She says:[27]

> "On paper, the government is on board. In December 2014, the Bombay High Court ordered all municipal corporations to provide safe and clean toilets for women near main roads, and 96 sites have been identified for future public toilets. The money is there, too: In last year's budget, the local government promised 50 million rupees (0.75 million USD) to build new toilets. A year later, not a single brick has been laid, and the funds are in danger of being reallocated."

SMART CITIES MOVEMENT IN BRICS

124 ....

Conclusion

The lack of safety for women in India emanates from the larger problem of regressive mindsets. Patriarchy as an overarching structure in South Asia contributes to the cities being unsafe for women. Women in public spaces will continue to be subject to the oppressive male gaze and violence unless the male segment of the population is sensitised to be respectful to their needs of security and mutual respect.

To achieve this macro-level change, each family needs to take active measures to sensitise and educate their children on matters of safety and security. The state must do its part by sensitising the governing bodies and, most importantly, the police force and the judicial machinery to ensure enforcement of laws that cater to the interests of each section of society and are non-discriminatory towards the disenfranchised groups. Micro-level planning measures such as design elements, safety applications and reviving neglected spaces and building gender-sensitive infrastructure, such as provision of public toilets and water facilities for women in the cities are complementary to the macro-level changes urgently needed in the cities. Smart, respectful citizens will help pave the way to a smart city.

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15

Smart Facility Location Planning for Smart Cities: Using GIS Technology and Facility Provision Standards for Pro-active Planning of Social Facilities to Support Smart Growth

– CHÉRI GREEN AND GERBRAND MANS –

Abstract

This paper describes a rational approach to the planning of social facility provision aimed both at eradicating service backlogs of the current period as well as preparing for the future. For more than a decade now, a GIS-based methodology has been used in South Africa to assess and plan for the provision of social facilities and to provide input to integrated social facility development plans which are not only defensible but enable smart decision-making that impacts meaningfully on investment priorities. This creates the greatest impact from the least number of investment locations to maximise return on investment. To support this work, the Council for Scientific and Industrial Research (CSIR) has consolidated, refined and adjusted guidelines that not only specify a provision ratio for each facility but also define a specific distance that should be used to measure accessibility in different contexts. Planning and implementation flowing from this occurs in an environment full of pressures relating to insufficient resources to deal with the quantum of the development challenge, competing political and administrative priorities, and critical skills shortages. While not initially driven from a Smart City perspective and currently not enabled by real-time data, the approach can, nonetheless, be seen as a major step toward 'smart' planning processes to support smart cities of the future. A case study application in Cape Town is used to illustrate the application of the methodology of spatially matching supply and demand for facilities using GIS tools. These tools make use of guideline provision standards that combine both distance and capacity as an input to the models to achieve spatial alignment of new facility provision investment that can respond to city growth in a timely manner. To date, this analysis approach has been used to inform planning for capital budget processes in a number of cities to improve service access that impacts 28 percent of the South African population.

Introduction

Overview

The concept of smart cities has been taken up by many city leaders, Information Technology (IT) companies and scholars worldwide, leading to a flurry of publications in recent years. According to Geertman et al., there are two main discourses that can be traced to the origins of the concept of smart cities.[1] The first discourse relates to the 'smart growth' of cities in order for them to be environmentally and financially sustainable. This discourse developed in response to the development sprawl of cities due to private vehicle transport. The second discourse focuses on how Information and Communication Technologies (ICT) can contribute to the more efficient planning and management of cities. Caraglui et al. combine the two discourses in their definition by stating that smart cities emerge "when investments in human and social capital and traditional (transport) and modern (ICTs) communication infrastructure fuel sustainable economic growth and high quality of life, with a wise management of natural resources, through participatory governance."[2]

Geertman defines Planning Support Systems (PSS) as geo-information technology-based instruments that are dedicated to supporting those involved in planning in the performance of their specific planning tasks.[3] In the publication, *Planning Support Systems and Smart Cities*, PSS are put forward as providing an approach or environment where ICT is combined with geo-spatial analysis capabilities to provide smart planning support solutions to inform and guide, amongst others, the sustainable development and management of cities.[4]

The social facility planning work done by the Council for Scientific and Industrial Research (CSIR) falls within the scholarly and professional field of PSS. The approach also has sustainability (from a cost point of view) as a key aspect in its outcomes and it uses information technology and digital communication in the process. The information that feeds into the system when doing the accessibility analysis cannot yet be defined as "smart" per se as it is not yet live or dynamic in the true sense of smart ICT systems. It is, however, something which may become more relevant and viable moving into the future in continuing with this work. The approach can nonetheless be seen as a major step toward 'smart' planning processes to support smart cities of the future.

The use of social facility provision norms and standards, applied using advanced computer-based GIS analysis and following the Service Access Planning approach developed by the CSIR, has been a significant contributor to an effective and integrated means of identifying and eradicating social facility backlogs and ensuring that the cities of the future are better planned and provided with the necessary social facilities, as well as developing defensible and equitable facility investment plans in post-apartheid South Africa. It has provided a transparent platform for decision-making that ensures that new facilities are constructed in locations which have the greatest impact. The approach and tools enable clear prioritisation in an environment of competing priorities and insufficient resources to help planners make informed decisions. Further, this feeds directly into the recent initiative from the National Department of Treasury to improve built environment performance by spatial targeting of investment through the introduction of Built Environment Performance Plans (BEPP) that encourage densifications along key transport corridors, more

efficient use of land and infrastructure, and greater coordination of development within cities.[5]

This paper describes how access norms, which uniquely define both capacity provision ratios and access distance for different contexts, can achieve equitable facility provision for social services, in a just and cooperative manner, through the application of accessibility analysis modelling as customised by the CSIR. This contributes to human capacity building by means of evidence-based planning.

City and national government authorities in South Africa are faced with the daunting task of providing services to all communities within their jurisdiction in a fair, equitable and sustainable manner. Outcome 12 of the Government Programme of Action specifically requires government departments to develop geographic access norms and set targets for minimising the distances people have to travel to reach services where appropriate.[6]

The approach to accessibility analysis being used by the CSIR has over the past 15 years successfully assisted various metropolitan and national government departments in testing and refining their geographic access norms in the process of conducting facility accessibility audits. A key aspect of the approach is the development of integrated facility plans within and across different government departments within the same city. This integrated approach promotes city building though the creation and development of key nodes of multi-facility service provision clusters. The approach is unbiased and is based on spatial evidence to establish the most appropriate location for new investment to serve the most number of people in a spatially equitable manner, based on current or future population distibution patterns.

These tools and approach enable a spatial assessment of backlogs and planning of new social facility provision which support cities in making smarter decisions that are defensible and impact meaningfully with respect to available resource allocation. To date, this analysis approach has been used in four major metros (Cape Town, eThekwini, Johannesburg and Tshwane) where the outcomes have already been used for capital budget processes, the development of Integrated Development Plans and also to measure outcomes with respect to improving access to services. This research and implementation has already created an impact on social facility investment planning for over 14 million citizens (28 percent of South Africa's population). The projects aim to develop sustainable, integrated and rational social facility capital investment plans which enable the development of Smart Cities that respond to city growth and the needs of citizens in a timely manner.

This approach will be illustrated with a case study in the Cape Town metropolitan area which can be considered as 'best practice.' The rest of the paper discusses the developmental issues of South Africa, followed by a brief examination of some of the BRICS countries with respect to social facility planning and standards. The next section discusses the Cape Town case study, and the paper ends with some key observations for future consideration.

Developmental Issues in the South African City

Prior to the establishment of a democratic government in South Africa in 1994, facility provision was often subject to variations in investment policy based on different implementation agencies, racial policies, and the un-coordinated development and planning of facilities by different

organs of state, as well as an avoidance of mixed-use planning. This was exacerbated by the neighbourhood planning approach of the day which embedded facilities within neighbourhoods – making sharing difficult across areas – and facility numbers were based on a blueprint approach to facility provision standards. In many instances, provision was based on what can be called a 'silo approach.' This approach not only looked at each facility type in isolation but also considered the number of facilities per administrative unit, irrespective of population need or distribution within the unit. As a result, facilities were poorly located and unequally distributed. Some areas were well provisioned, while in others there was under-provision or a gross over-supply of certain facilities. Often, facilities were poorly located with respect to the broader community and the transport network.

Political changes in 1994 coincided with a new approach to planning which eliminated the top-down approach in favour of greater community involvement and a community-led needs approach. The new Constitution also guarantees all communities certain basic services – such as health, education and water – and this implies that communities must be able to reach such services to receive a minimum service level. It is a legislated requirement that local authorities in South Africa prepare Integrated Development Plans (IDPs) and develop performance management systems that promote development and deliver services that are accessible. However, the community needs-driven approach did not necessarily lead to a more equitable provision of facilities, and at that time little or no consideration was overtly given to standards and the technical evaluation of needs. In fact, a normative approach to planning was considered outdated in academic circles. The outcome was that in many instances, those with the greater voice were able to influence investment decisions and the establishment of new facilities was sometimes used to win political votes or favour, or to avoid being seen as "obstructing the will of the people." The influence of the ward councillor and the needs of the ward or administrative unit became key factors in the planning process. This was problematic for achieving equitable service provision, as often, the wards and other sectoral administrative units are unequal in area and in population, and do not have a homogenous or common land use. The boundaries of wards also occasionally changed.

Further, in the absence of any agreed future development plan for facilities or direction of growth, various bodies including national departments, foreign donors and NGOs often built facilities at locations that were not optimal in serving a wider community nor in contributing to the development of nodal growth, often leading to a mismatch in supply and demand.

For planners to play a significant role in shaping the future of South African cities and to redress the imbalances in facility provision, new ways of planning that are defensible and transparent are required to evaluate the social facility needs of all communities in municipal areas. This is especially critical in an environment with limited resources to address facility backlogs and at the same time build new facilities to meet the future development needs of a city.

Social Facility Planning Standards and Approaches in other BRICS Countries

Current assessment of planning standards in BRICS countries is limited as literature is highly sectoral. It has not been possible to find similar standards to those published by the CSIR.[7] This guideline document outlines both capacity threshold and access distance per facility for over 30

facility types, ranging from schools and clinics, to cemeteries and sports facilities.

In February 2016, China's State Council released a new set of urban development guidelines which aim to produce a framework to revitalise China's cities.[8] The guidelines' main aim is to stem sprawling car-dependent development, and also to improve navigability, provide better access to commercial and public areas, and promote less resource-intensive cities. These new guidelines apply the principles of sustainable urban development and bring several areas into focus, namely denser street networks, enforced urban growth boundaries, the increased prevalence of public transport and expanding mixed development. The latter specifically notes the objective of improved access to a diverse range of public and commercial amenities, including schools, supermarkets, retirement centres, hospitals, parks and cultural centres. These principles are similar to those used in South Africa for guiding social facility planning.

In India, the Urban and Regional Development Plan Formulation and Implementation Guidelines also speaks of accessibility.[9] However, no measurable facility access criteria has been identified in the report although a proportional allocation of land per land use type is noted.[10] In South Africa, there has been a move away from proportional allocations of land to rather using a specific population ratio per facility. The latter makes for a better account of settlement density and the number of people likely to use a specific facility. The Urban Planning Standards for Athani Town (India) does provide population ratios per facility unit as well as the land area required; however, no measurable access distance parameters are defined. It is noted that, in general, accessibility and percentage of land areas for social facilities and green spaces is considered as important.[11]

Comparative analyses of facility provision and access norms for Brazil and Russia have not been addressed.

Facility Location Planning Approach

The Service Access Planning approach developed for use with GIS-based accessibility analysis incorporates various aspects of relational spatial analysis and has proved to be a highly effective tool. Planning in this case is not done based on units such as blocks or suburbs but rather on the ability to reach a facility within a desired distance. Measurement of access is undertaken across invisible administrative boundaries and thus, any changes in these, which happen occasionally, will not impact on the service indicators or accessibility. The basic approach developed by the CSIR matches the supply and demand within a spatial context based on agreed upon access parameters, such as distance or time, in conjunction with provision norms, such as the population threshold per facility for a specific service. It uses the road network to measure the distance of travel rather than straight-line distance. Used together in the accessibility model, these parameters enable a spatial measure of sufficiency.

The key data requirements are:

- a detailed population base layer which preferably includes profile information (such as age, income and health insurance level) as the major determining factor of demand;
- a transport network as the key accessibility input; and
- the capacity of each individual facility as the supply input.

Standards and guidelines with respect to the provision of publicly provided facilities and services make service provision and backlog determination processes more easily quantifiable and transparent. The setting of standards which include spatial parameters allows for the more accurate measurement and balancing of supply versus demand and, through this, the identification of backlogs within a spatial context. The meaningful application of GIS-based accessibility is only possible when standards for provision (which include aspects of distance and a measure of capacity of supply) have been established and agreed upon.[12] To this end, the CSIR has consolidated and published the various planning standards used by local, provincial and national governments for most social facilities provided by the government. Some of these were tested and revised while undertaking assessments in four major metropolitan areas when using the accessibility analysis tools.

Besides the geographical locations of the facilities, the service capacities are used as an estimate of facility supply. In the absence of such data, other available information must be used as a proxy to estimate capacities. In general, the demand is determined based on population parameters for a group or a subgroup. For example, the people living in households who do not have health insurance have been identified as potential users of government healthcare clinics while the age profile of a population is the main indicator used for school demand.

In order to simulate the different transport modes such as walking, cycling, public transport or car travel, the road network distance or speed can be used per link in each instance. The most recent work has aligned all planning to distance as this can be better interpreted and is in line with government policy. In the case of emergency response services, e.g., fire and police services, a special layer is developed which is calibrated for travel by emergency vehicles.

The main tools applied for accessibility modelling and auditing are, firstly, the provision standards developed by the CSIR in conjunction with various national departments and city authorities; secondly, the service access planning procedures developed by CSIR; and, thirdly, the Flowmap software, developed at Utrecht University in the Netherlands. Key data and standards parameters are used as inputs to the model and the results of the analysis are mapped for visual interpretation using ESRI products.

Cape Town Case Study

This article makes use of the library analysis and integrated plan in Cape Town to illustrate the methodology, tools and some of the outputs.

Context

Although Cape Town was already inhabited by indigenous people for thousands of years before, Cape Town's European history began in 1652 when a trading post was established there on behalf of the VOC (Dutch East Indies Company). The first European settlers were mainly Dutch, with some French Huguenots fleeing religious persecution in their home country. Immigrants from other parts arrived, as well as slaves and indentured labourers from Asia. Today Cape Town is a world-

class cosmopolitan city, and the second largest city in South Africa. It is the legislative capital, home to the Houses of Parliament, and is the most southern city in Africa. The city boundaries extend over 59,886 hectares of land and in 2011 was home to 3,662,955 people. It has diverse settlement development, from leafy suburbs and coastal mansions to poor neighbourhoods and informal settlements. On the periphery of the city are major agricultural areas in which many of South Africa's world famous vineyards are found. Table Mountain National Park also falls within the city boundaries. The city's management strives to provide sufficient social facilities to meet the needs of all its inhabitants.

The Approach

In the process of planning to best accommodate growth, the CSIR was approached to apply its technology to assist the city in developing a plan to eradicate facility backlogs for the current period as well as ensure the proactive development of facilities to meet the city's growing needs up to the year 2032. The project involved access modelling of a range of different public facilities to spatially identify facility backlogs and potential optimal sites for new facilities to meet the

Figure 1: Location of Cape Town, South Africa

Source: Council for Scientific and Industrial Research, 2016.

requirements for 2014 and 2032. The city of Cape Town undertook its own growth projections for 2032, although the CSIR could have used Urban Simulation modelling to simulate and allocate growth for the city. The growth projections were used as input to the accessibility model in order to evaluate the location of the facilities' shortfall and to subsequently develop an integrated strategy to address the backlog. The study relied on the City's GIS staff to provide the data regarding the current provision and supply of facilities. The facility and population data were all disaggregated to a fine-grain hexagon layer for analysis. These were then linked via a connected movement/road network that realistically reflected the possible travel movement and took account of topography, direction and distance of travel, while enabling the shortest path allocation. Cleaning and verifying facility data was and generally remains a major challenge.

The analysis mainly focused on social facilities and the requirement to site facilities near residential areas and on the public transport network to limit travel costs. Access distance was measured only from places of residence.

For each facility type, service standards relating to access distance and capacity were set and agreed upon. These were based on the standards drawn up by the City of Cape Town's own departments as well as the CSIR National Guidelines.

The following were the study objectives:

- To conduct an audit and assessment to evaluate the spatial match of supply and demand for 2014 in terms of six service sectors each having one or more facility types. Sectors included those of Health, Education, Libraries, Parks, Sport & Recreation, and Fire & Emergency Services.
- To evaluate the need for the future provision/supply or upgrading of the social facilities in terms of sufficiency with respect to the 2032 population forecast from the Land Use Model.

In seeking locations for new facilities, preference was given to sharing, co-location and integration of sites and buildings by different departments as well as rationalisation where possible to achieve fewer, larger facilities of a higher quality. Slightly longer travel distances were considered to support larger facilities and achieve a greater concentration of facilities at nodal points and along the main travel network and especially within the Integration Zones identified in terms of the Built Environment Performance Plans. The latter supports the National Treasury approach to outcomes-driven planning.

Data Preparation

The entire study area was tessellated into hexagons to achieve the fine-grain analysis required for spatially accurate facility location planning. Three main data sets are required for this:

- Road network layer that has been cleaned and verified. This links each hexagon to every other hexagon and is used to assess distances to facilities.
- Facility data with attribute data indicating the capacity of facilities which is used as the measure of supply.

- Population data (stratified by age and income) and disaggregated to the hexagons and used for calculating demand.

In this study, two population data sets were used, namely, the 2011 population (as proxy for that of 2014) and the 2032 population forecast in terms of the Cape Town *Pragmatic Densification* Scenario.

An assumption included in the *Pragmatic Densification* Scenario was the containment of growth within the current urban edge, while the rate of growth was based on current trends and planned government housing projects. The scenario did not consider changes in the policies regarding land-use management other than the continuation of the existing densification policy along main corridors and selected areas. The City produced two other population forecast models to be used for Integrated Public Transport Network modelling, namely, *Business as Usual* and a more specific *Transit Orientated Development* scenario. All line departments were required to work on the *Pragmatic Densification* scenario for the 10 to 20-year master planning.

Audit and Planning Approach

The first step in an audit is to define the current catchments or the areas of influence of existing facilities. This is done using a set of basic catchment area analysis procedures. The Flowmap model allocates the demand to the closest facility which still has available capacity, but which is within a selected travel distance. This is done in competition and no double-counting occurs. Choices regarding the transport mode, the maximum acceptable travel distance and facility size constraints or limitations, if applicable, need to be determined before embarking on an analysis for each facility. Unconstrained, fully constrained and distance- or time-only constrained catchment area analysis techniques can be used. In the case of libraries, a distance constraint of five km for local libraries and 10 km for regional facilities was set in Cape Town. The standards that are applied need to be adapted for local context and standards may differ between areas that are sparsely populated and densely built-up areas.

Based on the analysis, a set of indicators is produced that reflects the current service provision of areas and the utilisation rates of specific facilities. The indicators include:

- average travel time to reach a facility with capacity;
- number and percentage of persons served for the city;
- area and percentage of land area served; and
- number of persons allocated to each individual facility.
-

Making use of the catchment area analysis process, the study area can then be divided into sufficiently served areas and unserved areas as shown on Figure 2, which represents the served and unserved areas for community libraries in Cape Town.

The production of maps showing served and unserved areas is invaluable for community and councillor interaction as well as for in-house communication regarding needs and/or future development plans. These maps, alongside the map showing only travel distance to the closest

Figure 2: Served and Unserved Population – Community Libraries 2032
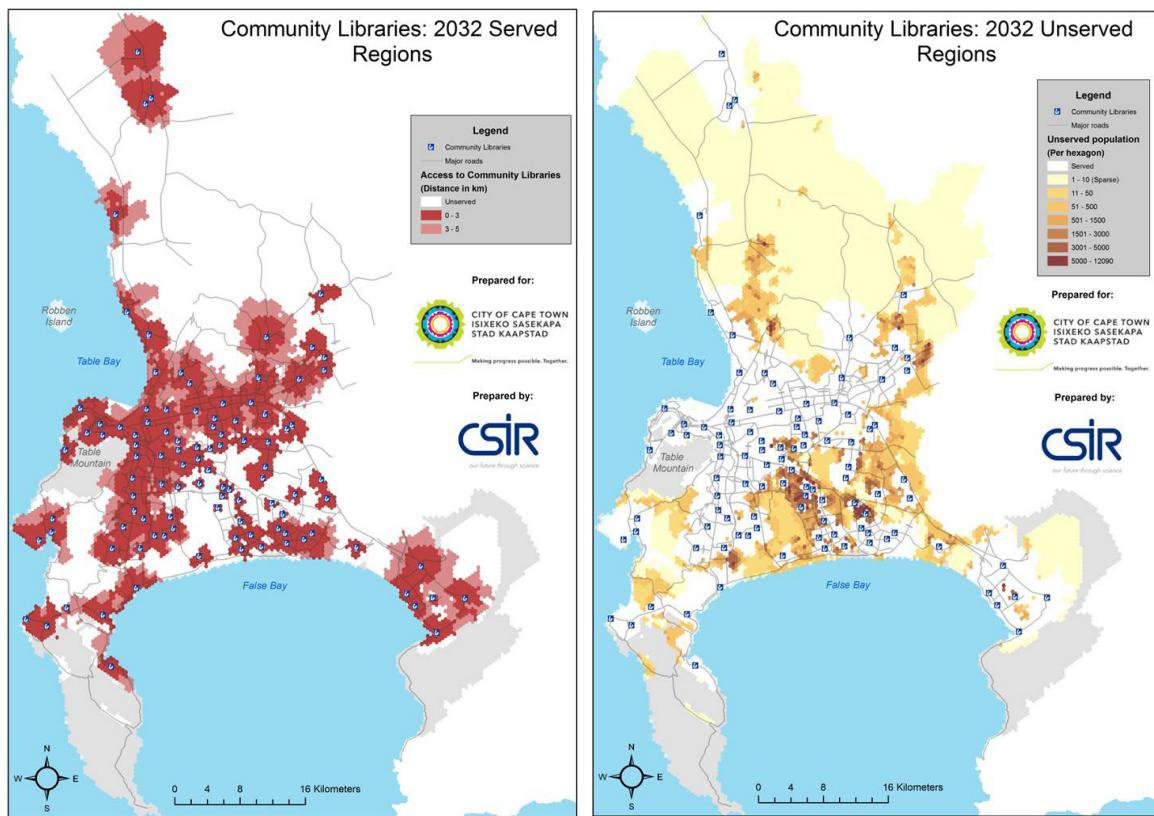
facility but ignoring capacity, are useful informants in the decision-making process and for adapting access standards to the local context.

The analysis enables the categorisation of residential areas in terms of the following:

- 'Well-served areas' where facilities are well located, users are within an acceptable access range and there is sufficient demand above the minimum threshold for a viable facility; and
- 'Poorly-served areas' where facilities are out of reach or overburdened and not all demand can be met due to capacity constraints.

Some areas may in certain cases be indicated as "over-serviced areas." This is where facilities do not reach full capacity due to there being too many facilities too close together and competing for the same market share. In this case, a reduction routine can be used to test a range of closure options.

The next optional step, but using the same modelled outputs as above, is to classify each facility based on utilisation (allocation) rates by comparing the current capacity to the modelled allocation of the demand. Some facilities may have spare capacity while others are over-burdened. The next requirement is to identify and analyse the unserved areas and population to assist in identifying locations for new facilities. The unserved demand for each facility type is analysed

by mapping density of the unserved demand. This is done by undertaking proximity counting to identify concentration of unserved demand within a set distance and by the running of an optimisation routine, as appropriate. The outputs enabled the identification of those locations where there is a sufficient concentration of unserved demand to support new facilities of a specified size.

While the proximity count provides a rough estimate of the number and location of new facilities that may be viable, it is not accurate. For greater accuracy, an optimisation analysis is used to locate a select number of facilities that are required to achieve a desired coverage, i.e., 100 or 80 percent target coverage solution. If the budget is constrained, it is possible to use the optimisation process to identify the best sites for an affordable number of facilities for each facility type. The optimisation analysis specifically allows ranking of the demand, which is critical for investment prioritisation.

Optimisation is a procedure undertaken with the Flowmap software where the model routine seeks out the optimal placing for possible new facilities based on the principle of maximising the number of unserved people that can then reach the new locations, based in this instance on average travel distance. The model uses a looped process to seek the top locations that meet the

Figure 3: Map of New Library Interventions for 2032
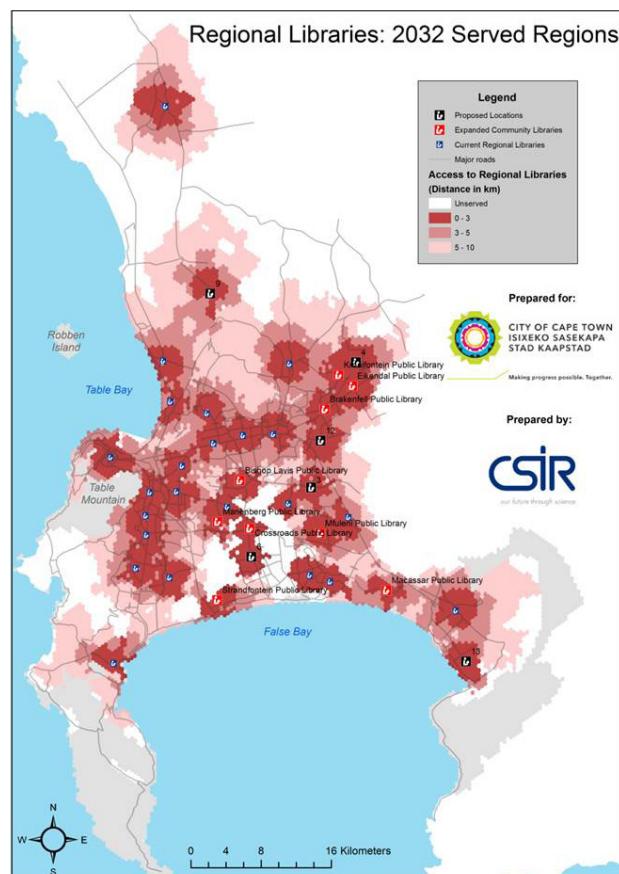
Note: For each number on the map, indications are provided about the library capacity required for the two time periods. The information is differentiated with respect to complete new facility requirements and those where expansion of current facilities is possible.

In summary, before 2022, four new facilities of a specified capacity and type should be developed and six facilities should be considered for expansion to better serve the community in their direct vicinity.

For 2032, six new facilities of specified capacity are required and three more libraries should be expanded.

criteria in competition with existing facilities.

Where there is insufficient demand to fully support a new facility within an area which has unmet demand, other options need to be considered. These could include questions of whether:

- existing facilities can be increased in size, operational capacity or hours of service;
- a longer access distance should be considered; or
- mobile or piggy-back services should be considered.

Development of Integrated Facility Plans and Communication

To make implementation practical and affordable, an integrated approach to the planning is followed. An analysis similar to that discussed for libraries can be undertaken for any number of facilities, from fire services to parks, and from health facilities to education. Every facility type needs to be individually analysed to determine the level of service achieved in terms of the target population year. Once all the proposed new facilities to meet the backlogs have been identified using optimisation, the integrated plan can be developed and communicated to stakeholders. This can be done for any period for which a detail spatial land use projection has been developed.

Following this, a process to identify suitable available land will be required. This can lead to some adjustments to the specific locations, although new legislation does allow for easier expropriation for specific uses. The latter is likely to be a last option. Where possible, a facility cluster should be developed, i.e., an education or sport precinct, or in other cases a multi-purpose facility or cluster can be considered. This should be located close to residential areas and should encourage mixed-use development where possible to limit trip making. A key element in the development of multi-facility centres is to examine the location of existing facilities, including for transport, which can form part of such clusters.

Assessing the myriad requests for new facilities emanating from line departments (and from consultants preparing plans on their behalf), as well as from councillors and communities, is time-consuming and is a challenge given skills shortages at the municipal level. The availability of the results from the accessibility modelling enables these to be more rapidly evaluated against backlog priorities and needs, and the GIS maps enable viewing of a proposed facility in relation to all other facilities, the road network, the population densities in the area and the quantum of unserved demand that exists. It enables locational maps to be used for communicating and debating the location of new facilities or for withdrawing support from facilities which have been shown to have limited impact.

In the case of Cape Town, the backlog plans which highlighted facility demand for 2032 were aligned to the Integration Zones and proposed building programme of public sector housing. The Integration Zones were identified in terms of National Treasury Neighbourhood Support Programmes which provide financial incentives to: (a) spatially aligned development and investment; (b) densify around transport and other infrastructure for greater efficiency; and, (c) densify selected areas of the city to eliminate inefficiency.[13]

Notwithstanding the priority and need for the facilities shown on the plans, all of the investment priorities indicated would be budget dependent.

Figure 4 is a consolidation of the results of the identified new locations for facilities based

Figure 4: Joint Plan of Investment in Identified Integration Zones supported by National Treasury
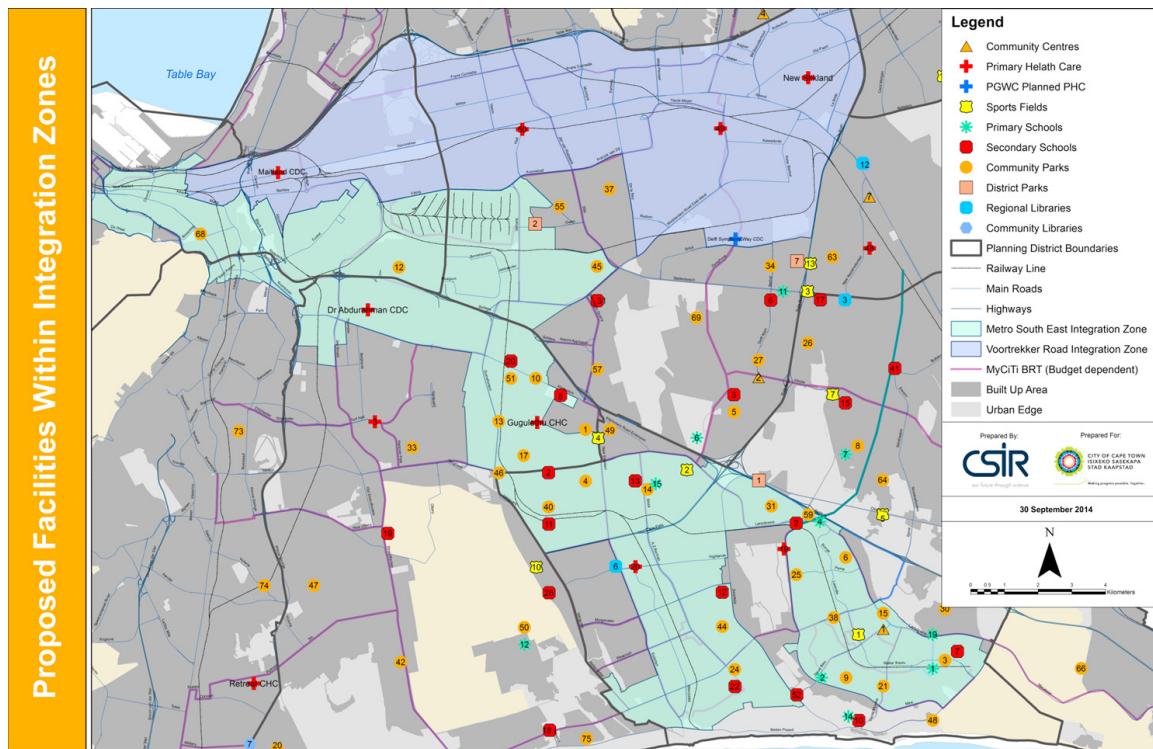
on the optimisation analysis. These newly planned facilities can be located within the Integration Zones and will be eligible for Neighbourhood Development Programme grant funding. This figure indicates where key facility backlogs can be aligned with the identified high-density public transport corridors. Further, it provides clear strategic direction to local planners, sector departments, private developers, donors and provincial and national government departments responsible for local facilities (such as health, education and library services) as to where the greatest social facility needs are and where the greatest impact or return on investment is achievable in the construction of well-serviced and accessible neighbourhoods.

The Investment Guide produced for the City provides significant input to the development of a Social Facility Investment Plan. It highlights the optimal location for future capital investment in social facilities required to meet citizen demand by 2032 and considering anticipated gravity points of need. The information presented reflects the prioritisation of capital investment for community facilities and gives a metropolitan perspective on priorities per sector, thus promoting smart decision-making into the future to support the demands of a growing city. All locations were linked as far as possible to public transport networks and nodes and intermodal exchange points. Final locations of facilities identified for capital investment will be affected by the final nature of the new development and on available vacant land. The study also confirmed the need to retain sufficient municipal-owned land for community use to accommodate social facility requirements rather than selling the land for private development. A similar approach

to planning has been used in eThekwini (Durban) since 2004, was applied in Johannesburg in 2012/13 for eight national departments and four local facilities, and the results of a similar study were presented to the City of Tshwane (Pretoria) in June 2016 to indicate priorities for social development for 2021 for the capital city.

Conclusion

The case study shows how the Service Access Planning methodology, when used in an environment with advanced computing, significantly enhances both current and long-term urban and regional planning and decision-making. Further, the goal of accessibility to services for all citizens can be accurately measured, thus achieving both equity and transparency. Planning officials are provided with solid decision support in an environment where a range of stakeholders all clamber to have their needs meet and where funds for capital investment need to be considered against the operational requirements and the necessity of the service.

Recommendations derived from the modelling results have been incorporated into the medium- and long-term planning of the respective service sectors investigated in Cape Town, eThekwini (Durban) and Johannesburg, while the results for Tshwane (Pretoria) will be used as input to the 2016/17 development plan. The results and maps are used in stakeholder meetings and budget planning to support and prioritise technical planning requirements. The results support planners' recommendations which had previously been difficult to defend to politicians and communities who may be concerned with their parochial needs without consideration of the more deprived situation in neighbouring areas.

The implementation of the integrated long-term plan of social facilities will make a major contribution to the development of more sustainable and well-provisioned living environments where future development is supported by well-located social infrastructure within the urban fabric. The plans also provide guidance to all developers, both in the private and public sectors, in terms of where facility investment is most critical and where it can significantly reduce the construction of white elephants or under-utilised facilities. A key factor in the quality of the spatial analysis is the enhanced computing power that enables the development of fine-grain analysis which is spatially accurate; thereby, supporting detailed local-level planning that was not possible 15 to 20 years ago. This can have a major impact on planning for integrated service delivery. The optimisation tools used also better inform the budgetary process for facility provision to maximise impact.

Equitable strategic level spatial facility location plan can be developed because of the following:

- Norms and standards have been consolidated and agreed to. These are currently being differentiated for use in small towns and rural areas in South Africa.
- The GIS tools enable accurate spatial disaggregation of population demand data at a fine grain, while greater computing ability enables use of complex algorithms that simultaneously match thousands of origins (supply) and destinations (demand).
- Using a transport network for simulating movement patterns for modelling, approximates real

links and accounts for topography and/or major barriers as opposed to defining catchments by drawing circles around facilities.

- The approach and tools provide a defensible empirical base for the determination of facility needs amongst different wards and planning regions and sectors.

- The approach enables the co-location of different facility types as part of a multi-purpose centre or priority investment hub since a common analysis base is used.

- The approach enables backlogs to be spatially determined in relation to population need. The outputs support the planning of facilities where they are needed and where people live irrespective of ward boundaries and political processes.

- Longer term monitoring and planning is possible based on established procedures, and thus, progress can be monitored.

Notwithstanding the major contribution of the approach and the use of its associated tools, there are some constraints to its widespread use if the facility databases do not exist or are not maintained and updated. Most of the problems experienced with the application of the models were related to data collection and verification.

The use of the service access planning approach described in this paper is most cost-effective if the activity can be sustained over a reasonable period of time (three to five years), and if there is at least a certain degree of in-house capacity building and technology transfer.

As illustrated by this case study, the GIS accessibility analysis, together with the availability of facility provision standards and guidelines are major elements in supporting planning. However, the process followed in government to implement the results and ensure these results impact on capital budget choices are critical steps in ensuring that development needs are addressed in pragmatic, efficient and sustainable ways. The approach indicates how past imbalances in service provision to specific communities can be identified and redressed, thus significantly supporting the planning and governance processes within cities.

The Service Access Planning approach using accessibility analysis and used for facility location has been developed by the CSIR over more than a decade. These tools and processes have been applied to assist South African provinces and cities to make smart decisions. They provide capacity to planners and other decision-makers to enable them to make better rational spatial investments that aim to eliminate service backlogs of key social facilities. Facilities planned in this way over the past decade cover schools, clinics, hospitals, crèches, libraries, cemeteries, community halls, home affairs offices, multi-purpose government service offices (called Thusongs Centres), fire and ambulance stations, police stations, social grant (SASSA) application offices and pension pay points as well as selected recreational facilities.

A major improvement in this type of modelling will be possible if comprehensive real-time data on facility provision and size are available. At present, the time and effort required to obtain, clean and verify data results causes project delays and rework that could be avoided through the application of more technologically enabled facility data capturing and updating.

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16

The 'Vale-Transporte' Policy: Transport Financing for Low-income Workers in Brazil

– CARLOS HENRIQUE RIBEIRO DE CARVALHO –

Introduction

Brazil is a developing country whose urban population grew extensively in the last century. This has had major consequences for its urban public services, particularly for urban public transport (UPT).

With the poorest of the urban population settling on the outskirts of cities, far from where jobs are located, public transport has become crucial to ensure their mobility. Transport to and from regions far from the developed centre comes at a high economic cost. As public transportation in Brazil is not subsidised, the high cost is transferred to users – transport tariffs are, in turn, high. These transport costs were eating up a large proportion of the incomes of low-salaried workers, and 30 years ago a social policy was formulated to address the issue. Called 'Vale-Transporte,' this policy has become one of the main benefits received by Brazilian workers over the last three decades.

This article presents the context surrounding the public policy, and the results of its implementation in Brazil's major cities. It also discusses the technological advances made in the management of the policy.

Urban Development and Mobility Systems in Brazil

Brazil currently has a little over 200 million inhabitants, about 85 percent of them living in urban centres. There are 36 cities with over 500,000 inhabitants in the Brazilian urban network, and another 40 metropolitan areas housing more than 80 million Brazilians (more than 40 percent of the population).

Brazil's urban centres have been growing rapidly in population since the second half of the last century. This sudden transformation of a once predominantly rural country into an urban one has had major impact on its people's mobility.

Urban growth over a short period occurred in a disorderly and deregulated environment. Cities grew without proportional expansion of their transport and traffic infrastructure. The

Table 1: Growth Rates of Population and Urbanisation Rate in Brazil, 1940-2010

Decade	Total Population Growth (%)	Urban Population Growth (%)	Urbanisation Rate* (%)	Over 500,000 Inhabitants Cities**
1940-50	25.9	72.8	26.4	2
1950-60	36.7	72.0	36.2	3
1960-70	33.1	66.1	45.5	6
1970-80	28.2	55.4	56.8	9
1980-90	21.3	35.8	68.9	14
1990-00	15.6	21.8	77.1	19
2000-10	12.3	16.4	81.3	27
2010-20	-	-	84.2	36

* Percentage of population living in urban areas at the beginning of the decade considered;

** Number of cities with a population of 500,000 inhabitants at the beginning of the decade.

Source: IBGE.

result was that the quality of public services deteriorated, especially public transport. Again, road transport has become hegemonic, mainly because it has greater operating flexibility than rail. Further, low-income families depend heavily on public transport for their daily travel.

An important aspect of the relationship between urban growth and mobility is the exclusionary way in which cities have grown. The rapid increase of the urban poor due to migration and high birth rates meant that this social class either lives in the more distant areas of cities with little

Chart 1: Modal Split of Urban Travel in Brazilian Cities, 2013

(Towns with a population over 60,000 inhabitants)
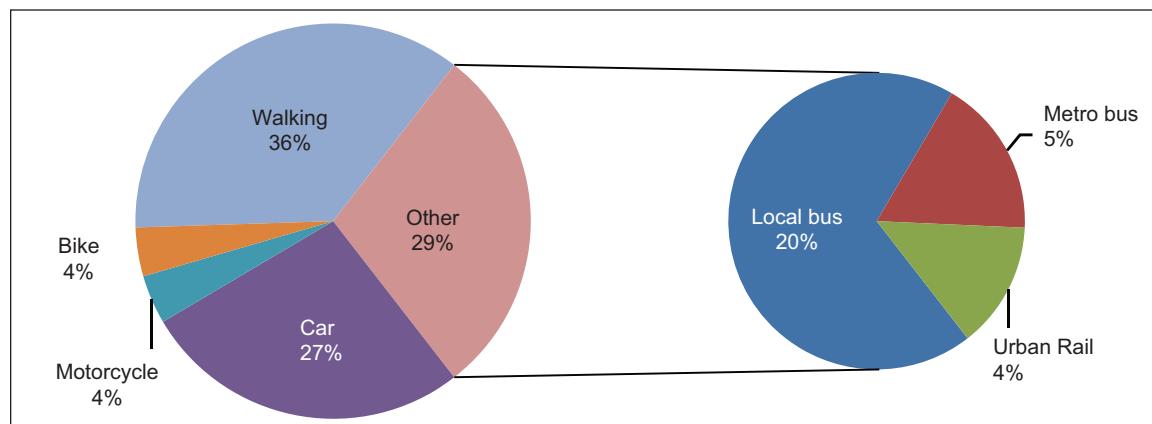
Source: ANTP, 2015.[1]

urban infrastructure or in illegal slums. Thus, poor people are highly dependent on the public transport system for access to employment opportunities. At the same time, the public transport network has become more expensive due to the increased distances for travel.

As a result of this exclusionary trend, the poorest workers spent more than 30 percent of their income in the mid-1980s on commuting to and from work. Fresh increases in public transport fare led to frequent violent popular protests. Due to inflation, tariff increases became increasingly frequent, generating strong social discontent. The creation of 'Vale-Transporte' (VT) was an important solution to this problem, since it gave workers the assurance of daily transport without heavily compromising their incomes.[2]

In addition to VT, other measures aimed at ensuring low cost transport for the low-income population have also been taken, such as free travel for those over 65 years of age, irrespective of income, gratuity for disabled people, along with tariff benefits for students, especially those from low-income families. This article focuses on the VT policy.

The 'Vale-Transporte' Policy: Ensuring Transportation for Low-income Workers

VT aims to ensure low cost commuting to work for low-income Brazilian workers using public transport. Brazil's Law 7.619 passed on 30 September 1987, makes it mandatory for employers to cover the commuting expense of their workers if this exceeds six percent of the workers' basic salary.

The VT policy was inspired by the 'Versement Transport' of France, which requires French employers with more than nine employees to pay a tax on payroll to subsidise urban public transport. The difference is that the funds raised in France are used by the government to subsidise transportation systems, while in Brazil, employers directly subsidise low-income workers providing them daily travel tickets, while deducting up to six percent of their salary.

An advantage of the Brazilian system is that it does not generate inefficiencies or distortions in the subsidy grant process since the transport companies are not involved. Transport companies are still encouraged to provide good service so as to continue attracting demand. The base of their revenue remains the paying passenger. But to ensure that the deduction by the employers is actually directed to the payment of transport, a specific credit system for public transport has been created – at first with currency paper tickets and recently, with electronic credits.

When the VT policy was first implemented, there was a lot of social tension in Brazilian cities. Every increase in transportation tariff — due to hyperinflation, the increases were frequent — led to recurrent violent demonstrations, which penalised the entire urban population. Low-income workers were the worst affected as they relied heavily on public transport. At the time about 50 percent of Brazilian families had a monthly income of less than three times the minimum wage. It led to high absenteeism at work especially at month-end, when many workers could no longer pay the bus fare to work. Thus, the VT policy contributed to the domestic economy, led to falling rates of absenteeism and also more equitable income redistribution, since low-wage workers had to spend only six percent of their income on transport.

The increase in individual motorised transport (cars and motorcycles) has also led to a fall in the need for UPT. VT has thus also become an important tool for maintaining the level of public

transportation demand. VT guarantees a minimum level of demand for public transport, reducing market fluctuations. This is fundamental to such economic activity which requires high long-term investments. Currently, VT accounts for about 40 percent of UPT systems' revenue in Brazil. Almost all cities with availability of public transportation have automatic ticketing systems that provide electronic credits to users of VT. Chart 2 shows the percentage of VT used in relation to the total tariff revenue.

In terms of UPT funding policy by the productive sector, the French system is more effective, since the tax imposed effectively makes the employer contribute to the transport expenses of every worker. In Brazil, companies pay only for low-income workers' commutes—those whose UPT expenses exceed six percent. Table 2 gives an estimate of Brazilian workers in the formal sector that could potentially benefit from VT. Considering an average fare of (Brazilian) R$ 3.50 (about US$ 1.00), it is estimated that workers receiving 1 to 1.67 times the minimum wage who make two trips per day, would benefit from VT policy. Workers who make four trips per day benefit from VT policy when they receive up to 2.5 times the minimum wage according to IBGE's monthly employment survey.[3] It may seem a small amount, but according to SMEs, about 40 percent of the workers of the main Brazilian metropolitan areas earn up to 1.67 times the minimum wage and about 70 percent up to 2.5 times the minimum wage, which shows the scope of VT policy to benefit workers in the formal sector in the country.

Chart 2: VT Use Level in Brazilian Municipal Systems, Brazilian Capital, 2012

Source: NTU (2012).
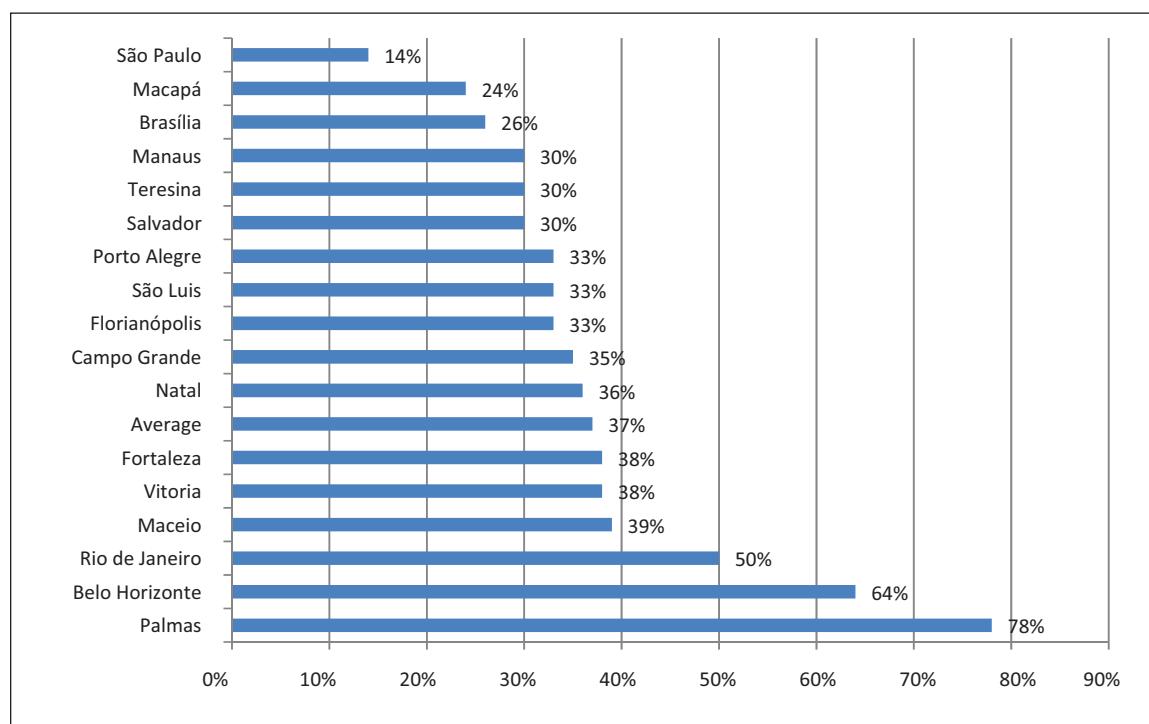
Table 2: Income of Formal Workers in Brazil, February 2016

(excluding domestic workers) and Impact on Income Expenses in UPT

Wage Deciles	(R$)	Proportion Minimum Wage	Impact: 2 fare/day		Impact: 4 fare/day	
			(R$)	(%)	(R$)	(%)
1	900	1.16	84	9.3	168	18.7
2	1000	1.29	84	8.4	168	16.8
3	1200	1.54	84	7.0	168	14.0
4	1300	1.67	84	6.5	168	12.9
5	1500	1.93	84	5.6	168	11.2
6	1800	2.31	84	4.7	168	9.3
7	2000	2.57	84	4.2	168	8.4
8	3000	3.86	84	2.8	168	5.6
9	4500	5.78	84	1.9	168	3.7

Note: Data for Metropolitan areas of Sao Paulo (SP), Rio de Janeiro (RJ), Minas Gerais (MG), Pernambuco (PE), Bahia (BA), Rio Grande do S. (RS).

Source: IBGE, 2016.

On the other hand, the main criticism of the VT policy is that its scope is restricted to formal sector workers. In metropolitan Brazil, about 40 percent of workers are in the informal sector and do not have access to tariff benefits in the UPT system (Chart 3). This section of workers earns less than formal sector workers and therefore are in greater need for VT, since transport costs have greater impact on their incomes. There are more people moving by non-motorised means (bicycles or foot) in this group, even when they travel long distances.

In this poorest group there is also a higher incidence of workers who are forced to sleep on the streets, where they can be close to their place of work, or are restricted to doing informal jobs close to their homes since they cannot afford transport. According to data from SME/IBGE (Table 3) the cost of UPT for the poorest 10 percent of informal sector workers can be more than 30 percent of their income, when they have to make two or more trips from home to work. This greatly compromises their livelihood.

The advantage of the French UPT financing model is that the contribution of the companies' subsidises the transport system as a whole, which means reducing the fare for all users without distinction, thereby also benefiting informal workers. In Brazil the policy is more effective but it is focused solely on formal sector low-income workers, while low-paying jobs are more in the informal sector. This means that where there is greater poverty, there is no effective transport social policy. That fact can be seen in Chart 4 which reveals transport assistance data received by

Chart 3: Percentage of Formal Workers, Informal Workers and Those on their Own, 2014
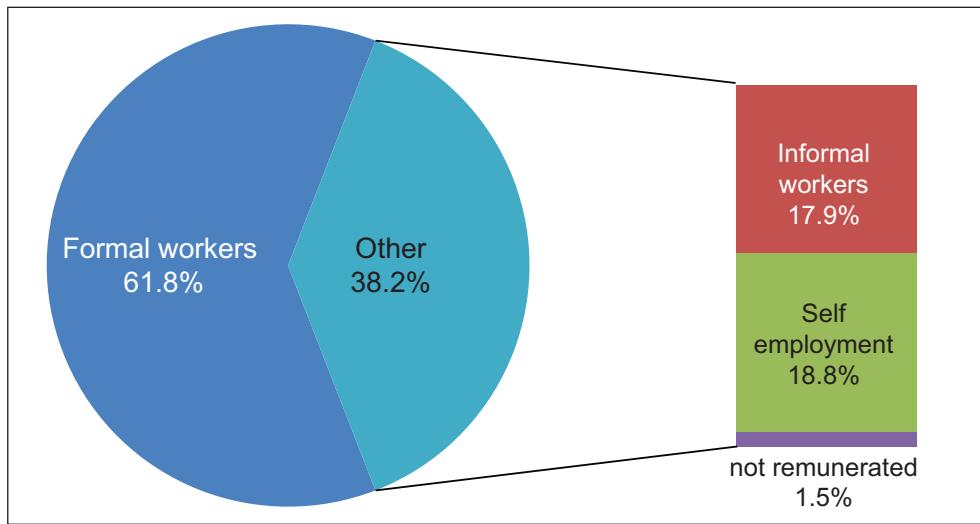
Note: Data for Metropolitan areas of Sao Paulo (SP), Rio de Janeiro (RJ), Minas Gerais (MG), Pernambuco (PE), Bahia (BA), Rio Grande do S. (RS).

Source: IBGE, 2014.

Table 3: Income of Informal Workers in Brazil

(excluding domestic workers) and Impact on Income Expenses in UPT

Wage Deciles	(R$)	Proportion Minimum Wage	Impact: 2 fare/day		Impact: 4 fare/day	
			(R$)	(%)	(R$)	(%)
1	550	0.71	84	15.3	168	30.5
2	850	1.09	84	9.9	168	19.8
3	880	1.13	84	9.5	168	19.1
4	950	1.22	84	8.8	168	17.7
5	1000	1.29	84	8.4	168	16.8
6	1200	1.54	84	7.0	168	14.0
7	1500	1.93	84	5.6	168	11.2
8	2000	2.57	84	4.2	168	8.4
9	3200	4.11	84	2.6	168	5.3

Note: Data for metropolitan areas of Sao Paulo (SP), Rio de Janeiro (RJ), Minas Gerais (MG), Pernambuco (PE), Bahia (BA), Rio Grande do S. (RS).

Source: IBGE, Monthly Employment Research, February 2016.

Chart 4: Percentage of Workers who receive Transportation Subsidy (%) by Salary Range, Brazilian Metropolises, 2014
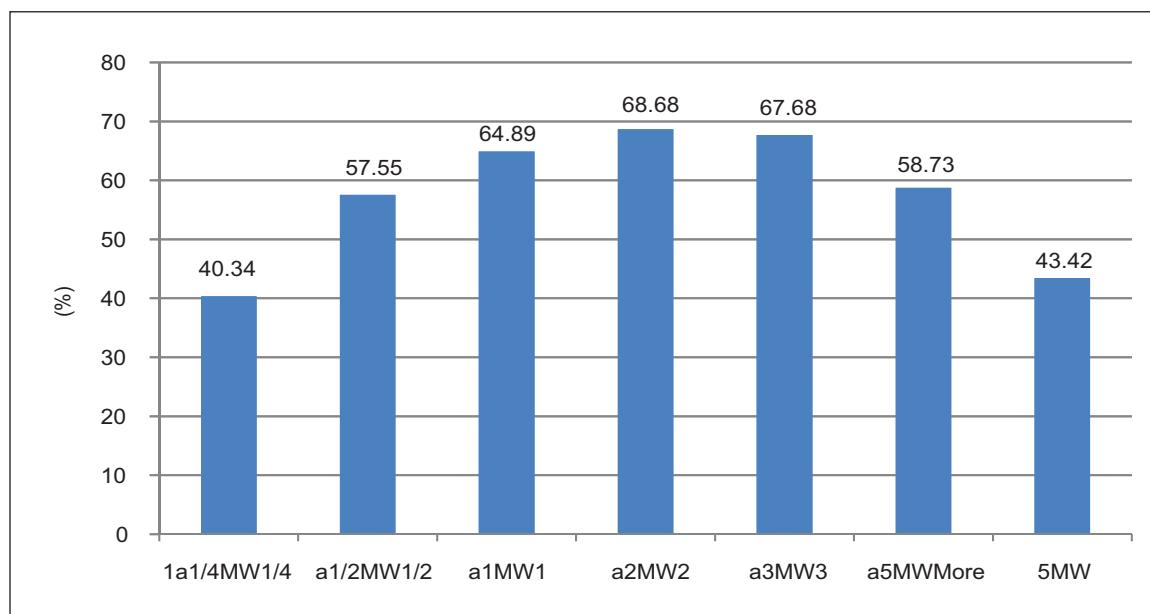
Source: PNAD/ IBGE, 2014.[4]

the population by income obtained from the National Survey of Household Samples - PNAD / IBGE.

Technological Advances in VT Management

Brazil's VT policy management has evolved a lot in the last 20 years, mainly due to the adoption of electronic ticketing for most cities. Before fare collection was automated, the benefit of VT was provided with paper tickets, which created a parallel, illegal market in tickets. This worked to the detriment of employers (who spent more than they should), workers (who sold coupons at a discount) and also the transport companies (who bore the brunt of fraud and forgery). The management of gratuities also created many problems, especially involving systems fraud. All these problems resulted in loss of revenue.

In the case of VT, the major innovation in the credit distribution procedure was the process called "charge on board." After previous registration of beneficiaries and distribution of personalised cards to employees, the employers have to buy travel credits for them online. The system sends the data to the agencies which have to validate the transport network (buses and stations). Workers automatically receive these credits the first time they use UPT after the payment by the employer has been confirmed. Figures 1, 2 and 3 show the logistical and technical process behind this measure.

From the user point of view, the company can buy VT credits for every employee once he is registered. The purchase is made online and processed by the central server. After processing, the central system sends a message to that effect to the bus garages or transport stations. When the worker makes his first trip of the month, credits are automatically stored on his smartcard (Figures 1 and 2). Even if the worker loses his card, he can still recover all unused credits.

Figure 1: VT Credits Distribution Process (charge on board)
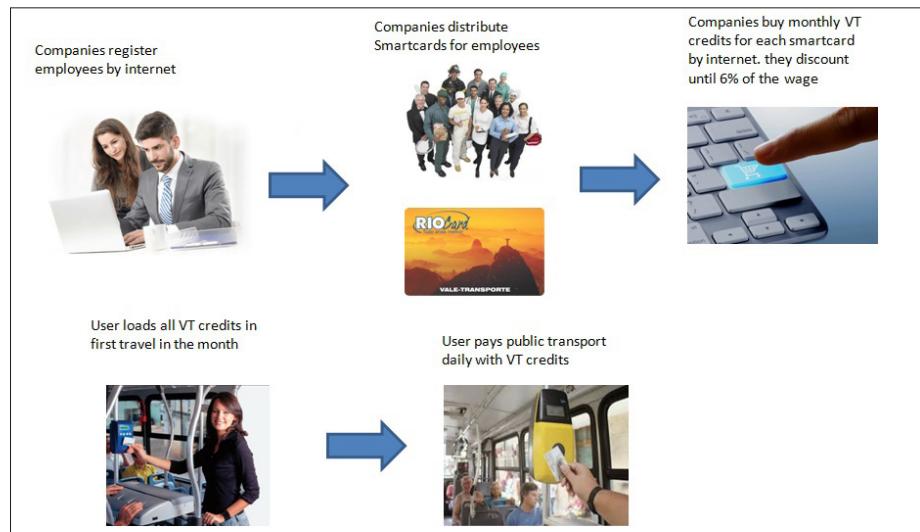

Source: Author's own elaboration.

Figure 2: VT Credits Distribution Process (charge on board), Transmission Credits Purchased List
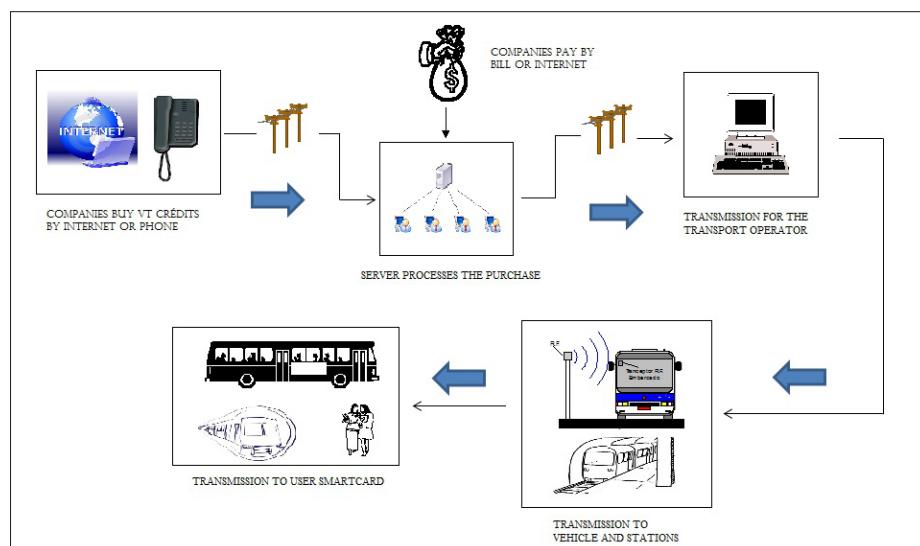
Source: Author's own elaboration.

The compensation claims after payment is made are also processed automatically by a data transmission system. Every day, vehicles and stations which must validate the process transmit discounted VT credits data to transport operators who send them to the central server. After data processing, the central administration makes payment to transport operators and sends usage reports to the purchasing companies (Figure 3).

Figure 3: VT Credits Distribution Process (charge on board), Transmission Credits Purchased List, Compensation Claims and Payment Operators
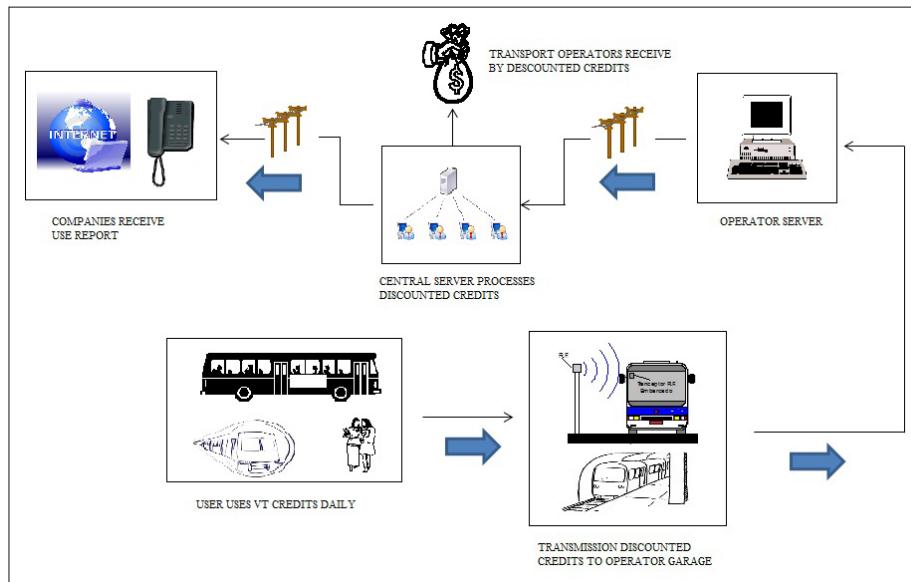
Source: Author's own elaboration.

This process allows every company to have full control over the grant of the benefit to its employees. In addition, in case of non-use of the credits in a particular month, they can be used the following month, which was not the case when paper tickets were employed. This process reduces employer costs. Before automatic ticketing was introduced, there were employees who sold their VT and used other means of transport, especially non-motorised, to get to work. Depending on distance, this compromised the productivity of labour.

Conclusion

Brazil's poor populations are highly dependent on UPT, even with the increase of individual transport in recent years. The VT policy has ensured that formal-sector, low-income workers do not lose too much of their income on their daily commute. This policy was a major social advancement for this category. At the same time, employers also benefit from it as it leads to lower instances of absenteeism.

Technology has evolved in recent years, allowing complete digital management of this benefit.

This greatly strengthened the policy, increasing convenience for companies and users. However, the policy excludes lower paid workers in the informal sector. Those who need it most are denied it. There have been legislative proposals for providing free travel tickets for the unemployed to enable them to enter the job market more easily. But the current economic crisis has stalled these proposals.

Regardless of the economic situation, it is essential to have policies that enable the poor to travel to work easily. The strengthening of the VT policy is a step in this direction, especially at a time of crisis when social inclusion policies are fundamental.

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17

Biophilic Cities: Planning for Sustainable and Smart Urban Environments

– ALESSIO RUSSO AND GIUSEPPE T. CIRELLA –

Abstract

More than half the world's population now lives in cities. According to a United Nations report, urbanisation combined with overall growth of population could add another 2.5 billion people to urban areas by 2050. As a result of urbanisation, many cities are facing social and environmental problems that have seriously compromised citizens' health and wellbeing: the urban heat island effect, CO_2 emissions, soil sealing, biodiversity loss, air, water and soil pollution and climate change. Holistic planning is needed to tackle these problems, integrating nature-based thinking into urban environmental development.

Research indicates that sustainable and smart biophilic cities achieve and maintain a higher standard of living than others and project higher living standards the longer they operate. The idea of biophilic cities is inspired by conservationist E. O. Wilson's concept of 'biophilia' that invokes our innate affinity with nature and maintains that increased integration with nature within an urban landscape has human benefits. A biophilic approach that enhances green infrastructure can provide significant gains for cities, including a wide range of ecosystem services and an improvement in the social and psychological condition of residents. This paper discusses exploratory ideas relating to the advantages of biophilic cities.

Introduction

Today, more than half the world's population lives in urban areas. According to a UN report, urbanisation combined with overall growth could increase global urban population by another 2.5 billion by 2050.[1] Mega-cities with more than 10 million people are increasing in number. India, for example, will have six mega-cities by 2020, thereby becoming the country with the largest concentration of mega-cities in the world.[2]

The consequences of increased urbanisation and sprawl are apparent. Many cities suffer from social and environmental problems that have seriously compromised citizens' health and wellbeing. Infrastructure design and socio-spatial disparities within cities are emerging as critical

determinants of health.[3] Air pollution problems in mega-cities and in their immediate vicinity will continue to be a top environmental concern.[4] Effective planning and political strategies for the urban environment are needed to improve local air quality and provide other benefit-oriented inputs, such as energy saving and the reduction of overall health risk.[5] In modern cities, building integrated greenery systems and urban green spaces plays a key role in improving the aesthetic and environment quality of life of its residents. In particular, greening the built environment provides ecosystem services and goods.[6] The ecosystem services concept provides useful benchmarks and performance indicators to link science with planning of policies and design applications.[7] The ecosystem services approach provides an opportunity for land-use planning to develop ecologically sustainable cities. Currently, information on ecosystem services of urban regions is lacking, and there is a need to improve the knowledge base for land-use planning.[8]

Urban residents need an ambience that is close to nature more than ever and more work is needed to find creative and effective means of incorporating greenery into urban environments – that is, biophilia.[9] The concept of biophilic urbanisation is inspired by Wilson's 1986 idea of 'biophilia,' which suggests that people have an innate affinity with nature and that increasing the presence of nature in cities can lead to an increase in benefits.[10] Recent studies have shown that biophilic urbanism leads to reduction of stress, depression and anxiety, enhanced productivity, quicker healing from illness and increased physiological immunity.[11] The goal of biophilic urbanism is to ameliorate the contemporary urban disconnect with nature, making the experience of the natural world a more integral part of ordinary city life.[12]

Recent literature on the subject confirms the need for integrating aspects of nature into urban environments. It assists in partially bringing back the human-nature connection in urban areas. Interdisciplinary research identifies a number of these benefits, including: better management of stormwater (excessive supply of water following heavy rain or snowfall); countering the urban heat island (UHI) effect (when the temperature of an urban cluster becomes significantly higher than its surroundings); increase in property values, in the physical activity of urban residents; improvement of urban amenities; longer lasting infrastructure; and reduction of dependency on vehicles.[13] Biophilic urbanism is emerging as a planning and design approach for holistic improvement of urban spaces with combined focus on physical setting, urban design, lifestyle as well as attitudes and experiences.[14] If urban development does not increase the presence of nature, overcoming past or ongoing depletion and damage to nature, the natural life support system will eventually collapse.[15] The aim of this paper is to present the concept of biophilic smart cities and to review some of the ecosystem services provided by biophilic urbanisation.

Biophilic Smart Cities

The concept of smart cities has promoted the application of engineering system solutions (e.g., information and communication technologies (ICTs)) to urban problems, and consequently has shifted attention away from environmental aspects of the city to those oriented towards infrastructure and information use.[16] ICTs, an umbrella term that includes any type of communication device or application, lacks particular emphasis on environmental sustainability.[17] There is therefore great need for a strong concept that integrates engineering system solutions with

environmental sustainability in cities, while reducing the impact of environmental degradation. Therefore, the concept of smart cities should be integrated with that of biophilic cities, with the overarching aim of addressing environment-oriented issues. According to Beatley, "a biophilic city is a city that seeks to foster a closeness to nature – it protects and nurtures what it has ... actively restores and repairs the nature that exists, while finding new and creative ways to insert and inject nature into the streets, buildings and urban living environments."[18] Compact cities, characterised by relatively high population density, mixed land-use, and pedestrian-oriented habitation, lie at the foundation of biophilic cities[19] and have been proposed as one solution for sustainable urban planning.[20] For example, Singapore is a compact city that is considered a good model of a biophilic city, where the development of green areas and green buildings is regenerating the natural systems of the city and creating an urban ecosystem similar to its original structure.[21]

Ecosystem Services Provided by Biophilic Urbanism

Biophilic urbanism that integrates nature into urban environments can deliver a wide range of ecosystem services, which include air quality, CO_2 reduction, microclimate benefits, flood control and water quality, food production and economic benefits.

Air Quality

A biophilic planning approach can directly affect local air quality. Green infrastructure can substantially reduce the impact of air pollution in cities. One study[22] found that trees annually remove 312.03 Mg of air pollutants in the city of Guangzhou, southern China. Another[23] found that planting vegetation in street canyons can reduce street-level pollution concentrations in those canyons by as much as 40 percent for nitrogen dioxide (NO_2) and 60 percent for particulate matter (PM).

CO_2 Reduction

Nature in cities can contribute to climate change mitigation as urban vegetation removes CO_2 from the atmosphere and stores carbon as biomass.[24] Further, urban vegetation can offset anthropogenic CO_2 emissions in cities.[25] Zhao et al. calculated that urban forests in Hangzhou, China, offset 18.57 percent of the annual carbon emitted by industrial enterprises through sequestration, and stored a carbon equivalent of 1.75 times the amount of annual carbon emitted by industrial energy users within the city.[26]

Microclimatic Benefits

A biophilic planning approach can help decrease land surface temperature and mitigate urban heat island effects. Peng and Jim found that extensive green roofs reduced pedestrian-level air temperature by 0.4–0.7°C, and intensive green roofs by 0.5–1.7°C.[27] The cooling effects were not restricted only to rooftops, but also extended to the ground to improve neighbourhood microclimate in Hong Kong. Russo et al.[28] found that in Bolzano, Italy, urban trees reduced streetscape temperatures by up to 2°C during the summer and improved human thermal comfort.

Flood Control and Water Quality

Urban green infrastructure can mitigate flooding by reducing runoff peak flows and volumes.[29] Many green infrastructure practices such as rain gardens, vegetated swales, green roofs and porous pavements filter or remove stormwater pollutants, which leads to improvement of water quality in cities.[30]

Food Production

Growing food in cities is an important biophilic urban design strategy.[31] Sustainable urban agriculture can reduce food queues, urban hunger, unemployment and poverty in cities. Sustainable urban agriculture can deliver a multitude of ecosystem services that can benefit the urban community in developing as well as developed countries.[32]

Economic Benefits

Economic benefits from biophilic design include higher workplace productivity, improved health and healing, increased retail potential, less crime and violence, increased property values and employee attraction, and increased liveability in dense areas.[33] For example, improving the aesthetics of the local landscape increases people's enjoyment of an area, and attracts businesses, which in turn can attract customers, employees and further services.[34]

Discussion

The studies above have highlighted the positive impact of nature-based integration within urban environments. Biophilic urbanisation produces a bundle of ecosystem services that range from provisioning services (e.g., food production) to cultural services. An overview has been provided of different services that biophilic urbanisation can bring. However, further research is needed to choose and select appropriate ecosystem services indicators and 'smart' indicators for the development of smart biophilic cities.

Conclusion

A biophilic planning approach has the potential to provide significant benefits not only in BRICS countries, but also beyond. It includes a wide range of social and psychological benefits to residents, as well as functional and economic benefits to cities at large. Cooperation between BRICS countries is needed to facilitate knowledge-sharing on research, policy reform, biophilic planning and smart-innovation, which can encourage cities to become sustainable and resilient to climatic events. In addition, there is need for new financial instruments to support smarter urban infrastructure and technology and sustainable biophilic urban environments. More investment in sustainable public transportation, along with green networks for cyclists and pedestrians, can reduce urban air pollution, encourage physical activity, lessen traffic injuries, and reduce the costs of mobility for poor and vulnerable groups.[35] Planning for a sustainable and smart urban environment is complementary to the engineering of biophilic cities.

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18

International Friendship Park as a Symbol of Good Neighbourly Relations

– ALEXEY V. PARNYAKOV AND VALERY A. SAVOSTENKO –

Abstract

The article describes the history of the small parks constructed as monuments of friendship between the sister-cities of countries located on the Pacific coast. The article covers the main stages of the design and construction of these facilities, and contains a chronology of the construction of each park individually, with brief descriptions. On photographs, parks can trace their single concept (key characters), such as pearl, the entrance gate or amphitheater. Owing to the efforts of hardworking people, architects' enthusiasm for the creation of such recreational facilities endures.

Introduction

The Pacific Rim Parks are fine examples of landscape artwork made by a group of architects and artists from different countries around the Pacific region. These parks are their gifts for the people of the world, through which universal friendship is celebrated. Most of the participants are students from different universities around the Pacific. Working in collaboration with, and under the leadership of artistic director James Hubbell, the participants are studying how to deliver a peaceful message to the world by using the art of landscaping. The idea behind the Park is to design and create it in one month, as explained below.

Week 1 – The site is surveyed, country culture is introduced, initial sketching is conducted, along with discussions and brainstorming. This is followed by making models of the future Park in international groups.
Week 2 – Models are discussed and finalised in consultation with James Hubbell. Thereafter, architecture drawings (master plan, elevations, sections, details, perspectives, among others) are prepared. The final drawings and model are presented to the local governments for their approval.

Weeks 3 and 4 – Construction goes underway, after which the final presentation to the local area is made, and final conclusions are shared.

Working in such a project is, no doubt, an enjoyable engagement for everyone involved. It gives them the unique opportunity to create a landmark artwork dedicated to peace and friendship in the world.

General Information

The international project on creating friendship parks will be celebrating its 20th anniversary. The idea of creating such parks is owned by the famous American architect and designer, James Hubbell. In his opinion, this project is unique in terms of not only its creation, but also serves as a platform to communicate, and share experiences of students and teachers from around the world. Establishing such cultural ties of sister-city relations certainly enhances the credibility of the Russian and other Pacific countries. At the invitation of Gennady Turmov, rector of the Far Eastern State Technical University (FESTU), James Hubbell—a thought leader and mastermind of the future friendship park—visited Vladivostok in the autumn of 1993. Within the walls of the university, he lectured to students and reviewed the future construction site next to the academic building and specific area of the city. In the spring of 1994, a delegation of American and Mexican students and teachers arrived in Vladivostok. The idea for the project was then born. The team of volunteers joined students and architects from FESTU. The project was sponsored by the FESTU administration, city hall, and commercial firms. Within a month, they had come up with an image of the future park, finishing their design drawings, making the layout and creating with their hands, on a small plot of land, a landscaped ensemble symbolising friendship between peoples.
The phased plan of work for the month is described below.

Week 1 - Roundtable is organised to understand the relationship between the participants, and for the presentation of cultures of the participating countries. Trips to the main attractions of the city and its surrounding areas are undertaken, with a few stops for doing photography, drawings and sketches. Talk sketches are drawn. Site design is checked. A second round of planning sketches on existing situation is carried out. Frame areas are analysed in character. Work is discussed at the round table, with the inclusion of a dialogue between the audience and Milenko Matanović, professional psychologist and architect Kyle Bergman. Here, sketches dealing with elements of small architectural forms are drawn.

Week 2 - The next stage of design. Project participants are divided into groups of people from different countries to create the layout of the future park. Layout material used is clay and plasticine. Layout presentation is made and a group discussion follows. The final layout is created by the participants, guided by James Hubbell's ideas. Drawing is prepared on the scale of the project. This is followed by presentation and defense of the project of the entire group of participants before the concerned committee. The committee consists of representatives of the administration, architects and project sponsors.

Week 3 - Start of construction. Participants are introduced to the work plan for the day, and participant groups are formed to perform certain types of work: plot layout, foundation, masonry (brick and stone), creating mosaics and forging planting. For many students, it is their first encounter with these or other similar types of work. In this case, a specialist is needed to lead; that specialist is James Hubbell. Every few days there is a change of groups working on different fronts, allowing participants to try their hands at various tasks. With the necessary experience accumulated in one kind of work, participants share their work with newcomers.

Week 4 - Preparing for the opening ceremony of the monument. Completion of the improvement includes planting trees and shrubs, landscaping. Grounds maintenance and watering activities are carried out, and the project is completed.

Examples of Completed Friendship Parks

Soul and Soil Park (Vladivostok, Russia)

This park was constructed during the period May- June 1994 (Figure 1). Its wooden arch was set in 1995. The amphitheater is located on the slope. Inside, it is made of stone; outside, trimmed bricks are used from old buildings. Materials used for improvement are natural stone and brick. Wood trim is used for seating as well as for the main entrance arch. For the front wall decoration, small pebbles, sea shells and coloured glass bottles were used, as well as pearl finished pieces of white marble. Participating countries included Russia, the US, and Mexico.

Figure 1: Soul and Soil Park, 1994 (Vladivostok, Russia)

Pacific Rim Park (San Diego, US)

The second park was built in San Diego (US) in 1998, on the other side of the Pacific Ocean. The place of the future park was a small peninsula in the city centre (Figure 2). Amphitheater is formed in a fan shape. Manufacturing material used is concrete. Pearl ceramic tiles are used to form a mosaic in the shape of a compass, adorned with images of animals identified by the participating countries. Input forged arch covered with turquoise paint has openwork weaving and reminds everyone of a firebird. Participating countries included the US, Russia, Mexico, and China.

Figure 2: Pacific Rim Park, 1998 (San Diego, US)

Pacific Rim Park (Yantai, China)

Built in July 2001, the composition of park (Figure 3) is divided into two areas at different levels. The upper playground is square-shaped, while the lower is semicircular. Wall material and the basic composition are of white marble. Finishing site is of granite. Participating countries included China, the US, Russia, and Mexico.

Figure 3: Pacific Rim Park, 2001 (Yantai, China)

*Entre Corazon y Mar Park (Tijuana, Mexico)*

The construction of the park was carried out in July 2004 (Figure 4). The construction site has an elongated shape. Here, the interesting principle of "luring" visitors was applied. The site has step opening and subsequent access to the main amphitheatre, a drop-down on the Pacific Ocean. Materials used for the concrete lining are stone, ceramic tiles, and burnt clay tiles. Participating countries included Mexico, China, the US, and Russia.

Figure 4: Entre Corazon y Mar Park, 2004 (Tijuana, Mexico)

Salinlahi Pacific Rim Park (Puerto Princesa City, Philippines)

The park was built in May 2009 (Figure 5). Guests of the park are met by a wooden pergola supported by three original pillars of reinforced concrete. There is a small playground with a round shape in a spiral pattern trimmed with a shingle of different shades. The park, built on the island of Palawan in the Philippines, was born of a similar idea to the previous parks. The compositional centre of the park were two walls (waves), located below the exit to the stairs. Going down the stairs, a visitor can get to the second level, which offers a beautiful view of the Sulu Sea.

Figure 5: Salinlahi Pacific Rim Park, 2009 (Puerto Princesa, Philippines)

## Stepping Stones of the Pacific (Jejudo, South Korea)

The construction period of this park was between July and August 2010 (Figure 6). Park visitors encounter the wide side and split into two parts. In the middle is a wooden pergola. Left of the entrance is a stone amphitheatre, with the outside covered with earth. In the inner perimeter is located a stone bench in the middle of which is a statue of a pearl, mosaic tiled. It offers a magnificent view of the ocean. Right at the entrance is a stone spiral at the centre of which is "Haruban," stone symbol idol island, but in the female version, unlike the original male version. The park is surrounded by a stone wall, folded in the local manner puncturing without using concrete.

Figure 6: Stepping Stones of the Pacific, 2010 (Jejudo, South Korea)

Pacific Rim Park (Kaohsiung, Taiwan)

Parks friendship towns - sister cities are a unique opportunity for students, architects and designers to express themselves in international cooperation and exhibit friendship. They are also a source of inspiration and opportunity, as it is possible to show their creativity and apply it in real life. In the summer of 2013, it was built next to the park in Kaohsiung, Taiwan (Figure 7). The story continues.

Figure 7: Pacific Rim Park, 2013 (Kaohsiung, Taiwan)

All photographs have been taken by the author.

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172 ....

SMART CITIES MOVEMENT IN BRICS

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Urbanisation creates as many opportunities for societies as it does a gamut of challenges. Globally, more and more nations are pondering the concept of a 'smart city,' and examining the suitability of applying so-called smart solutions to the multifaceted problems of cities. This publication documents the experiences of BRICS countries with specific methodologies and reform measures they have employed to make their cities smart and liveable. The papers cover a wide range of subjects, including policy and governance, research methods, financial resources, people's participation, public safety, public services, and environmental sustainability. BRICS nations are home to nearly 40 percent of the world's urban population. Timely interventions based on knowledge shared will be instrumental in achieving this ambitious goal of making cities smart.