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STATEMENT OF THE PROBLEM

OBJECTIVES

HYPOTHESIS (ES)

RESEARCH METHODOLOGY

RESULTS & DISCUSSION

FINDINGS

RECOMMENDATIONS/SUGGESTIONS

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SMART CITIES – CHALLENGES AND IMPLEMENTATION APPROACHES: COMPARISON PERSPECTIVE IN INDIA, UAE AND SINGAPORE

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ABSTRACT

Smart Cities Mission under Ministry of Urban Development, India has released the list of first 20 smart cities with generic guidelines. Key objective of this mission is to promote cities that offer quality of life to citizens through connected infrastructure and a clean and sustainable environment by adopting 'smart' solutions with public private participation. While funding and governance issues need lot of coherent actions, implementation approaches and their impact on "smart city" service provider business models with potentially scalable ICT infrastructure poses lot of challenges too. Proactive and concerted participation of Urban Local Bodies (ULBs) and Public-private partnership companies, particularly managed service providers (MSPs) who will be one of the key factor deciding the success of India's' smart cities initiatives. Implementation approaches as planned in some of the global cities such as UAEs Dubai and Singapore shall be consulted to come out with integrated business models and innovative local partnerships (Local Ecosystem) that will suite India specific challenges. This may also help evolution of agreed standards, protocols and common data formats that facilitate interoperability across systems, ease the information flow challenges by MSPs, re-use existing infra-structure and put it to multiple use for faster deployment of smart city services.

KEYWORDS

smart cities, implementation challenges, ecosystem business model, managed services providers, services co-creation, smart city platform.

JEL CLASSIFICATION CODES

A13, L90, O18, O38, R12.

1. INTRODUCTION

Smart cities are cities that are conceived and built as an overlay of digitally 'Smart' and 'Intelligent' solutions that will lead to the adoption of at least 5 of the 8 following smart parameters—smart energy, smart building, smart mobility, smart healthcare, smart infrastructure, smart technology, smart governance and smart education, smart citizen.

By a definition given by Frost& Sullivan, a smart city is an enabling platform built by the government, for the people, to understand and manage the interactions between people and the infrastructure in a city and to guide informed policy making through the intelligent usage of technology. A report by Deloitte defines a smart city as "when investments in human and social capital, traditional (transport) and modern information and communications technology ICT infrastructure fuel sustainable economic development and a high quality of life, with a wise management of natural resources".

The integration of new aspects brought to take into account different and innovative factors in governance and management of the urban areas, and this process turned the focus on more complex conceptualizations such as the "smart city" (Schaffers et al., 2011) in which human and social capital and traditional and modern communication infrastructures are combined to carry on the sustainable economic growth and a higher quality of life through a proper management of available resources (Caragliu et al., 2011).

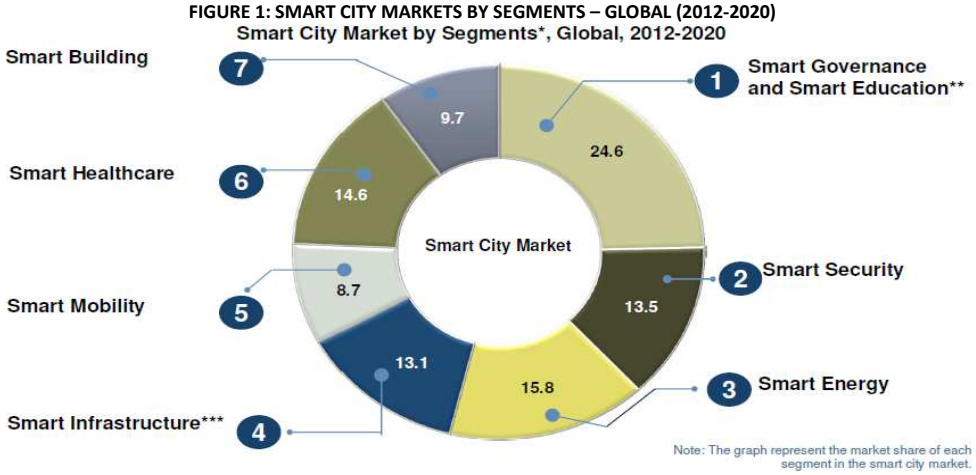
Almost all nations are facing the pressure on sustainable natural resources and effect of environmental degradation due to modern lifestyles, notion of "smartness" and "smart cities" is more of necessity for all governments. Irrespective of the constituent political or legal status, all nations and communities need to provide efficient systems for adequate water supply, assured supply of electricity, sustainable environment and hygienic living conditions with good sanitation, solid waste management, efficient urban mobility and public transport system, affordable housing communities, seamless IT connectivity and digitally connected network systems, safety and security of citizens, good e-governance and citizen participation aided by good healthcare and education systems.

Such an evolution leading to "smart nations" are possible only by adopting to well-planned implementation approaches. This paper looks in to the challenges and implementation approaches in select nations as a way to benchmark how Indian models shall adopt.

2. GLOBAL TRENDS SMART CITY INITIATIVES

Globally various cities have developed to achieve various stages of "smartness" while many cities are still in the process of implementing smart functionalities within their smart city plans. Priorities and inclusion of key smart services as part of smart city plans differ across countries while the majority of initial services will be driven by utility and municipal services such as smarty mobility, smart transportation and smart energy services. Report on Strategic Opportunity Analysis of the Global (Frost & Sullivan, March 2015) Smart City Market predicts the distribution of various market segments globally for smart city services is expected to be as below.

FIGURE 1: SMART CITY MARKETS BY SEGMENTS – GLOBAL (2012-2020)



As such many countries and smart city councils have issued guidelines, KPIs and consultative operating models. A notable one is the Public draft of European Innovation Partnership on Smart Cities and Communities which emphasizes various priorities and importance of strong citizen participation, co-creation of smart services by public and private bodies, seamless integration of services as "managed services" model by Managed Services Providers (MSPs). Currently published country specific guidelines mainly serve as a framework to all stakeholders and public and private partnership entities on how to integrate smart city solutions and services for existing cities and new developments. However, there are challenges about KPIs and metrics for each segment of services which cannot be uniformly defined due to diverse and local/regional specific challenges, especially India. Consultative paper released by Indian Chamber of Commerce and Deloitte ("100 Smart cities in India, facilitating implementation, Feb 2015) spells out financial, technical and institutional constraints that are specific to India. Some of the key concerns are:

- Limitations of technical capacity of ULBs and lack of related workforce talent
- Challenges in adopting to business models that will leverage PPP and outsourcing arrangements both for operationalizing and maintaining smart solutions and services with output based managed services providers
- Right mix of cloud based ICT infrastructure models required
- Need effective coordination required between different levels of ULBs, State and Central government agencies for sharing of best practices and sharing of service delivery processes
- Need for control of information flow and governance structure such as Central Control room with representation of all stakeholders with common database for sharing of data etc.

3. LITERATURE REVIEW

To study and compare the challenges and impact of Smart City implementation initiatives, it is apparent that major generic guidelines provided by International bodies such as European Commission released recently around 2013 would be a good source of information to start with [1]. Objective of this paper is to compare and contract smart city implementation approaches by India and other two growing national initiatives. Concept of smart city has been in the discussions since 2005 starting with smart grid implementations in major power companies. Also, Green Economy and sustainable development theories gained momentum during last decade. Guidebook released by Division for Sustainable Development under UN Department of Economic and Social Affairs (UN DESA) and other contemporary research reports have been instrumental in various Smart City initiatives across the nations.

Currently, urban and metropolitan contexts are increasingly influenced by globalization processes (Berry, 2008) and new technologies (Demirkan, et al., 2011). ICTs are now heavily involved in the governance and management of cities, where they are used as tools and as resources to improve quality of life, achieve sustainable development, and create a more open and innovative urban context through the participation of several actors (Anthopoulos and Tougountzoglou, 2012).

Premise of this paper is to compare various smart city initiatives to see how Indian Smart City plans are geared to face the challenges of implementation and rollout. Regional reports and state guidelines on Smart city plans especially from Singapore and UAE are consulted for reviewing Indian initiatives [8] [9].

Ranking of nations for their 'digital readiness's by evaluating all nations using a metric called Network Readiness Index (NRI), proposed by WEF Global Information Technology Report illustrates that effectiveness of governments has increased as a result of their ability to provide citizen-centric online services enabling citizen participation in governance [12]. The term "Smart" in smart city initiatives is fully dependent on how ICT is being used by nations for inclusive growth. Also, another ranking based on Global Competitiveness shall be used to gauge the level of public private participation possible which is the essence of smart city plans. In other words, sustainable development and smart living requires significant level of business cohesion and services integration enabled by robust digital ICT infrastructure.

4. SMART CITIES IMPLEMENTATION APPROACHES

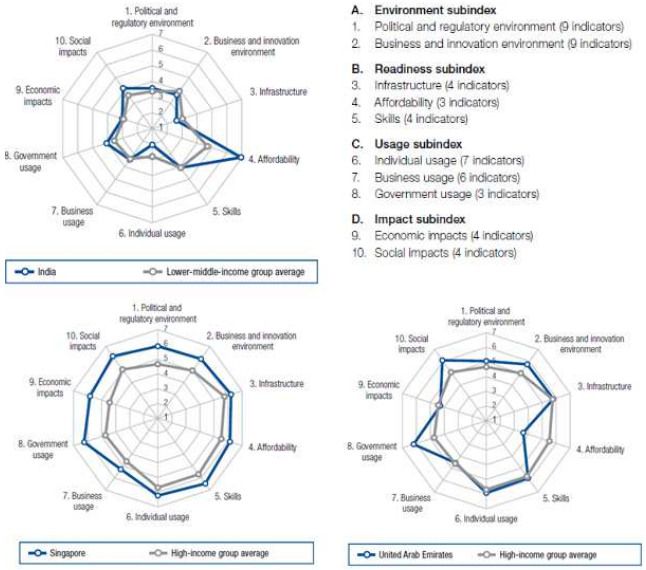
Current approaches to smart cities implementation in various countries are essentially driven by Government initiatives and incentives for public-private participation. World Economic Forum (WEF) yearly reports "The Global Information Technology Report" releases assessment of "networked readiness" of 143 economies every year using the Networked Readiness Index (NRI). Similarly, Global Competitiveness report (GITR) ranks the key factors and their interrelations that determine economic growth a country and its level of present and future prosperity. From Smart cities implementation perspective, these two indices are a good starting point to see how the individual nations should deploy smart solution models. While NRI provides the digital readiness of the nation that is vital for smart solutions, Competitiveness ranking will provide notable insights on how the private-public participation models will work under the given circumstances and guidelines for smart cities.

TABLE 1: RANKING HISTORY OF COUNTRIES UNDER DISCUSSION AS PER WEF GITR REPORTS

Country	Population 2015 (mn)	Ranking as per Global Competitiveness Report				Ranking as per Global IT Report (GITR) " Network Readiness Index"		
		2012-13	2013-14	2014-15	2015-16	2013	2014	2015
Singapore	5.5	2	2	2	2	2	2	1
UAE	9.3	24	19	12	17	25	24	23
India	1259.7	59	60	71	55	68	83	89
China	1367.8	29	29	28	28	58	62	62
Brazil	202.8	48	56	57	75	60	69	84
Russia	143.7	67	64	53	45	54	50	41
South Africa	54	52	53	56	49	70	70	75

Comparing India with UAE, Singapore and other BRICS nation on ICT Index, India stands low with 89th rank for year 2015. Though Indian mobile market is very vibrant and expanding with recent surge in ecommerce and many clusters of IT excellence and frugal innovation, India is yet to leverage complete ICT potential to this benefits. However, there are some two important factors which are very encouraging is that (a) Affordability of mobile services as a result of the fierce competition and (b) Approach to Smart Cities as individual cities than nation or region wide. However, while there are generic guidelines for Smart City programs, a lot need to be done to manage the challenges during planning, implementing and operating smart city solutions with active participation of private sector who will be billing the major part of funding and financial investments.

FIGURE 2: COMPARISON OF UAE, SINGAPORE AND INDIA AS PER NETWORK READINESS FRAMEWORK –GITR 2105

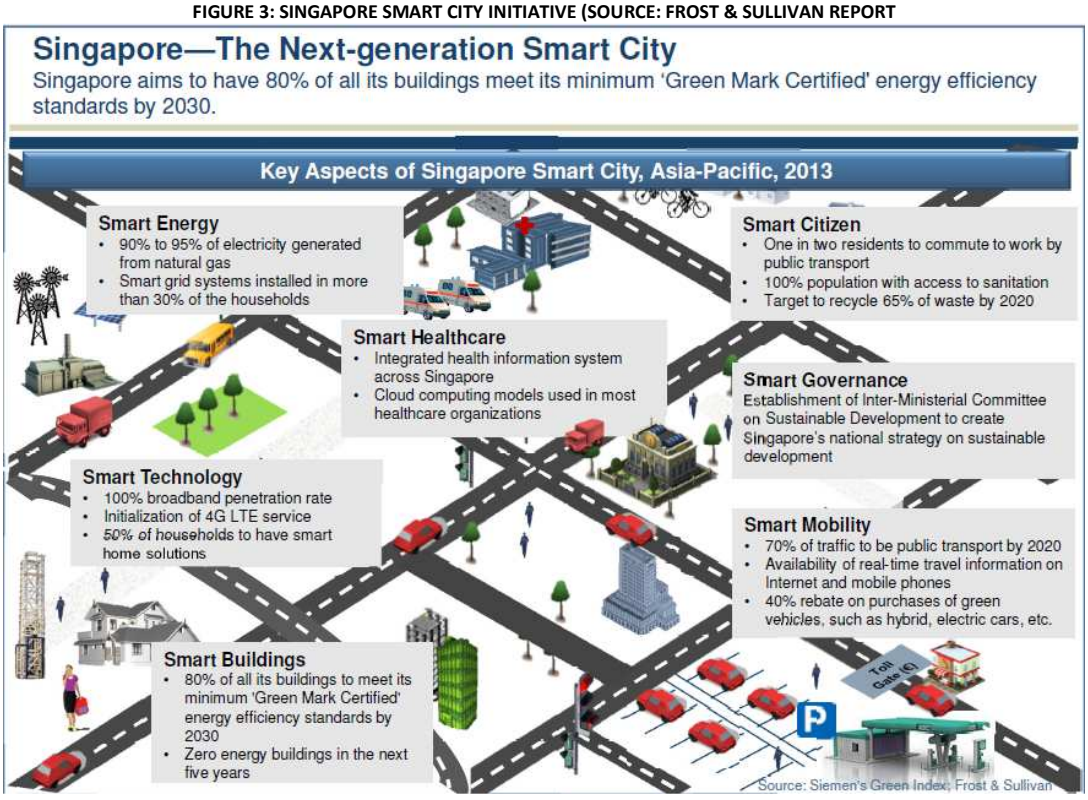


4.1 SINGAPORE INITIATIVES

Singapore as a nation has always in the forefront of technology driven national development. Recent reports suggest that Singapore is continuously leading the ICT revolution and digital initiatives, especially especially e-governance and smart city solutions. As per the Singapore governments published document on Smart City vision, a comprehensive plan is chalked out involving Singapore universities and medical facilities, multi-billion annual research and development (R&D) investments, fast-growing community of tech start-ups and large pools of investment capital.

Next Gen smart city plan of Singapore is centered on the premise of government and private sectors using ICT holistically to bring about better lives and greater business opportunities. This is substantiated by the fact that Singapore offers most conducive business and innovation environment worldwide and highly ranked for the quality of its regulatory framework. A good case of example would be how Infocomm Development Authority of Singapore has taken steps to develop an innovative technology platform in membrane and material advancements for water purification (pioneered by Hyflux). This method of clean drinking water production is now being used in several other countries as per Mr Steve Leonard, Executive Chairman of IDA, Singapore.

FIGURE 3: SINGAPORE SMART CITY INITIATIVE (SOURCE: FROST & SULLIVAN REPORT



4.2 UAE INITIATIVES

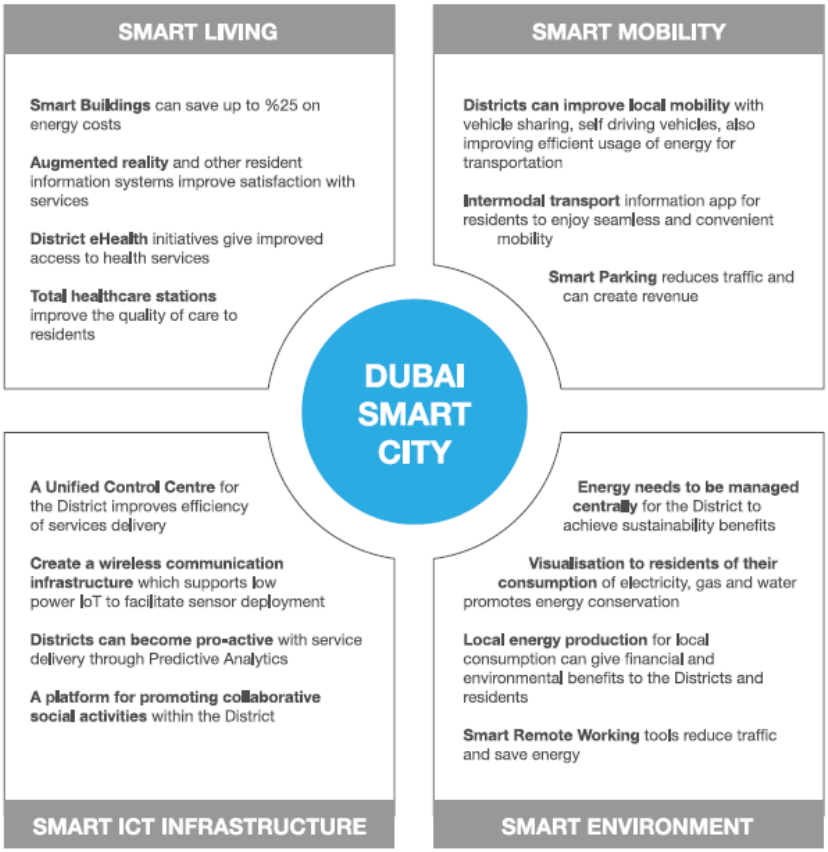
Among the six GCC countries, UAE has been in the forefront of development and technology advancements while Qatar is close behind. As per GITR 2015 Network readiness index ranking, UAE (23) and Qatar (27) lead among top 30, while Bahrain(30), Saudi Arabia (35), and Oman (42) are not far behind barring Kuwait(72). This implies that a very strong commitment to ICT development by their respective governments is a must to foster digitally enabled societies and smart cities.

Among UAE federal districts, Dubai is driving the smart city culture. With a population of about 2.5mn, this can be compared to growing Indian cities if not the metropolis cities. Smart Dubai Master Plan has envisaged smaller districts within the geographic limits of cities for design, development and delivery of smart solutions in alignment with Government entities and private sector partnerships. First edition of World Green Economy Summit was held at Dubai on 2014 and one of the key outcomes was to establish Public Private Partnership Platform to facilitate and showcase innovative projects partnerships and technology. Subsequently Smart Dubai initiative is established with an ambitious goal of reducing energy consumption by 30% by 2030 in alignment with Smart City initiatives. (State of Green Economy Report, 2015)

Some salient features for Dubai Smart City Master Plan and the guidelines provided in Smart Dubai District Guidelines (Smart Dubai, Executive briefing, March 2015) include:

- Defined KPI for Smart Dubai with Smart City Platform and benchmarking
- Smart Districts certification
- Shared real-time information for infrastructure planning, vendors and services best practices
- Platform-as- a- Service provided by City to be used as District dashboards, application and Centralized management services operations.

FIGURE 4: SMART DUBAI – SUMMARY OF GUIDANCE FOR FOCUS INITIATIVES FROM THE DISTRICTS



4.3 INDIAN INITIATIVES

Smart Cities – Mission Statement and Guidelines document issued by Ministry of Urban Development, Government of India by June 2015 is not prescribing any particular model to be adopted by the Smart Cities. Due to inherent challenges within India and the distributed nature of cities/districts that can be included in Smart Cities vision, India is in right path to not to adopt 'one-size-fits-all' and each city has to formulate its own concept, vision, mission and plan for a Smart City Plan (SCP) that is appropriate to its local context, resources and levels of stakeholder's engagement and participation.

Some key elements that are expected out of city/district specific SCP are

- Assured electricity supply with at least 10% of the Smart City's energy requirement coming from solar, Adequate water supply including waste water recycling and storm water reuse
- Sanitation including solid waste management and rain water harvesting,
- Smart metering, robust IT connectivity and digitalization
- Pedestrian friendly pathways, encouragement to non-motorized transport
- Intelligent traffic management and Smart parking
- Energy efficient street lighting & innovative use of open spaces
- Redevelopment and Greenfield building to be at least 80% buildings/Green Buildings

Of the total 200 cites planned, first 20 cities are now in the process of formulating implementation plans with slow momentum for Special purpose vehicles that will fund the majority of the projects under Public Private Partnership program.

Unlike UAE and Singapore, Indian Government has committed to the development of smart cities but the major onus in on State & Urban Local Bodies (ULB) to come out with city level strategies and operating models for timely and effective implementation. In other words, though select cities in India exhibit smart solutions as highlighted above, the challenge is to replicate these solutions on a larger scale and to augment specific functionalities to bring in additional smart / intelligent features.

Adoption of an integrated and replicable operating model among cities/ULBs is key to significantly reduce the time and cost of implementing smart city functionalities so that existing solutions can be leveraged both in the public and private sector enabling rapid scaling up of facilities.

5. PRIORITIES AND CHALLENGES

As recognized by Indian Government, there are key challenges in ensuring success for SCPs by different Cities/ULBs and district bodies.

Firstly, this is the first instance of "competitive and cooperative federalism" being exercised by promoting competitive spirit and autonomy to local bodies for development programs. This is will need lot of efforts from those competing SCPs for integration and implementation

Secondly, generic guidelines as given now need to be expanded in detail to ensure understanding the concepts of retrofitting, redevelopment and Greenfield development by various stakeholders with individual SCPs.

Thirdly, co-creation of services and citizen involvement is much more essential than just a passive participation in governance. Inculcating smart city concept and involvement of "Smart Citizen" in defining, deploying smart solutions need to be enabled by the SPV through increasing use of ICT, especially mobile-based tools.

Such challenges are also envisaged by smart city visions of UAE and Singapore which are in the same region as India and their respective guidelines for smart cities rollout provide vital points for Indian stakeholders to take note of and to benchmark prioritized KPIs. Table 2 as below compares Smart Cities Vision guidelines and priorities of India, Singapore, UAE approaches.

Understandably Singapore and UAE are smaller nations with good digital infrastructure and competitive business environment as established by their consistent rankings in WEF reports. Nevertheless, smart city approaches by India too on select cities to start with which shall be considered as 20 smaller nations from the perspective of comparison. Some of the salient points of Singapore and UAE models are

Singapore model is based on their superior infrastructure and availability of strong public-private participation scope. Citizen participation has been inculcated under strong government leadership for more than 30 years and hence Singapore vision is largely KPI driven. They have established various levels of KPIs to be achieved in specific terms especially on transportation and energy consumption. Especially they aim to achieve 50% citizen using public transport relies on their commitment to achieve their smart city vision. While there is no specific mention of centralized and government controlled information system to integrate, Singapore will have an inter-ministerial committee to oversee and regulate achievement of their prioritized smart city KPIs.

UAE on the other hand, with their federal governments of seven emirates, will chiefly focus on Dubai closely followed by Abu Dhabi which are similar to Singapore as a city with similarly population and economic profile. For obvious reasons Dubai has taken the lead as a serious contender to Singapore-like metropolis that are now under transformation to smart cities. UAE model is to encourage "smart districts" competing each other to achieve smart city goals while the Dubai Government actively providing an integrated digital platform for managing infrastructure, information and assets. Governmental control over information and interaction of various elements of smart solutions are more emphasized. It is to be noted that UAE cities such as Dubai have more expatriate communities and floating population as compared to Singapore and this explains why a centralized control of information flow connecting smart solutions are very much necessary.

From Indian perspective, more detailed levels of introspection are needed to percolate the objectives and broader guidelines of Smart City Plans which can be translated into realizable delivery models as more than 95% of funding and support will come from Public-Private partnerships.

Table 2 provides a high level comparison of Smart City Plan priorities & focus areas as published by respective: governing bodies in India, Singapore and UAE. This is clear that both Singapore and UAE have come out with more focused guidelines and KPIs leveraging their current status of "digital readiness", strong government control over civic infrastructure, expected people participation and progressive environment.

Singapore model is more KPI driven with clear mandate on achievable by inspiring and enabling public private partnerships. UAE model is similarly made with lot of expert consultancies input with stress on government/state authorizes enabling centralized information control by "Smart City Platform". Both approaches are valid given their national objectives and the configurable guidelines shall further be evolving as Smart City projects evolve.

TABLE 2: COMPARISON OF SMART CITY PLAN PRIORITIES & FOCUS: INDIA, SINGAPORE, UAE

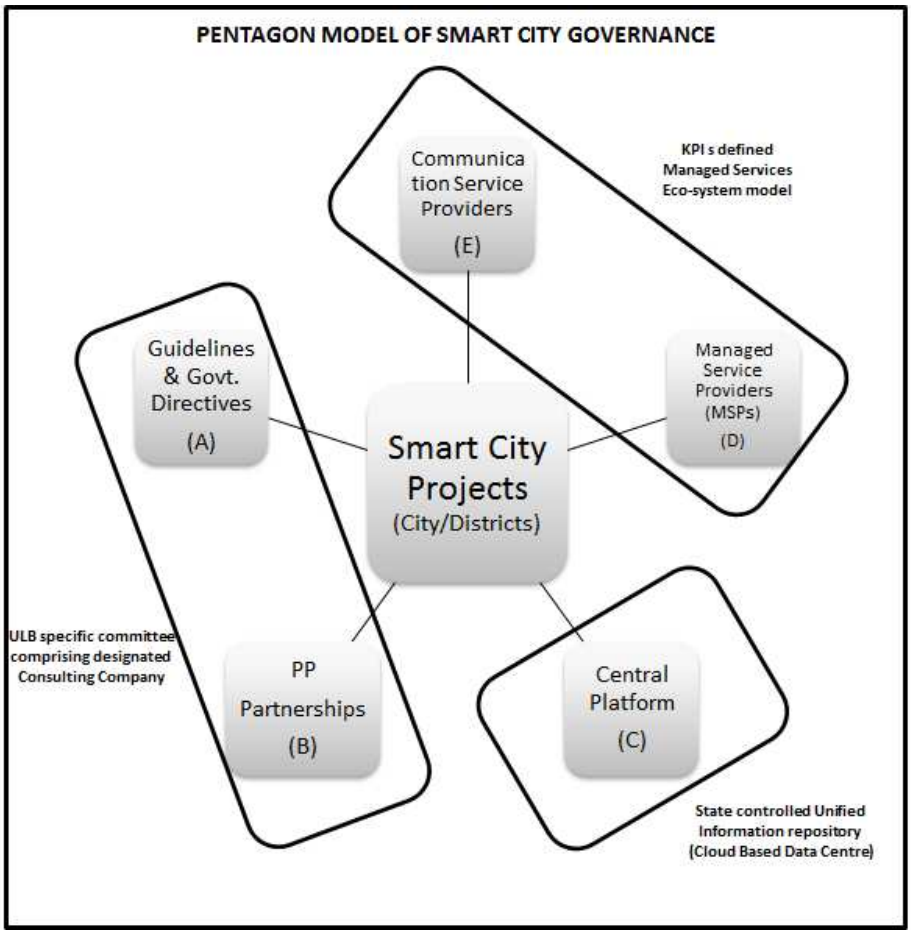
Focus area	India	Singapore	UAE
Smart Energy	Energy Management	Smart Energy	Smart Environment
			Smart District Certification
			Smart remote working tools
Smart Building	Energy efficient & Green Buildings	Smart Building	Smart Buildings
		Green Mark Certified house buildings (80%)	Centralised Mgmt. of Building Assets
		Zero Energy Building in 5 yrs	Security & Access control
			Lighting Management
			HVAC & CWS management
Smart Security		Smart Security	Fire Alarm System Management
			Smart Homes
			Home Energy Management
			Home Safety & Security
			Home Automation
			Home Health
			Home Infotainment
Smart Technology		Smart Technology	Smart ICT Infrastructure
		Broadband Penetration (100%)	Unified Control Centre
		LTE Coverage	Wireless Communication
		Smart Home Solutions (50%houshold)	Predict Analytics platform
			Smart City Platform
			(for collaborative social activities)
Smart Mobility	Urban Mobility	Smart Mobility	Smart Mobility
	Smart Parking	70% traffic by public transport	Infra for Smart Roads, Bridges, tunnels
	Intelligent Traffic Management	Real time travel information by mobile/web	Intelligent Transport System
	Integrated Multimodal transport	40% rebate on purchase of green vehicles	Smart Traffic and Parking management
Smart Infrastructure	Water Management (smart meters, leakage, water quality management)	Smart Infrastructure	Smart Infrastructure
			Smart water Irrigation
	Waste Management		Smart Waste Management
	(waste to energy, compost, reduction of C&D waste)		Smart Sewage Water
Smart Governance	E-governance & Citizen services	Smart Governance	Smart Governance
	Public info, grievance redressal	Inter-ministerial committee for sustainable development	Public Realm
	Electronics Service delivery		
	Citizen Engagement -Citizen Eyes& ears		
	Video crime monitoring		Facility Management
Smart Healthcare	Telemedicine, Tele education	Smart Healthcare	Infra. management including procurement
		Integrated Health Info system	Operations Managed, Managed security..
		Cloud Computing model in Healthcare	
Smart Citizen		Smart Citizen	
	Incubation, Trade facilitation centre	Commute to work by Pub transport (50%)	
	Skill development centres	100% population access to sanitation	
		Waster recycle 65%	

6. SUGGESTED OPERATING MODELS AND IMPLEMENTATION FOCUS

Implementation of SCPs in Indian cities with about 2-3 million approximate population similar to Singapore or say Dubai city, but with significantly less infrastructure development levels will require high degree of coherence and coordination among different stakeholders such as utility companies, telecom operators, security surveillance services provider, municipal authorities, IT infrastructure providers and all others. Thus, Indian model of SCP implementation should be well planned with focused operational metrics, ecosystem business models with social entrepreneurship culture, co-creation of service packages depending upon local needs.

As envisaged by Indian Government, specialized consultants are awarded the responsibility of providing expert guidance's to various ULBs and municipal bodies to operationalize city specific Smart City Plans (SCPs). Given the guidelines and practical challenges that are expected in Indian context, following operational model is suggested while operationalizing SCPs [Fig 5].

FIGURE 5: PENTAGON MODEL FOR GOVERNANCE OF SMART CITY PROJECTS



At each municipal or ULB level a committee or governance body shall be instituted to manage the SCPs in five different key result areas as per this Pentagon model (shown as A, B, C, D and E) with specific measurable KPIs.

City specific designated Consulting companies can ensure consistency in Guidelines & Government Directives [A] while a steering committee from ULB shall oversee PP partnerships [B] as per funding and other financial arrangements as mandated by Special Purpose Vehicle (SPV) model. (Chintan, et al) However, for effective Governance and Control of A and B, there ought to be sub committees or control groups with well-grained KPI objectives, tools and systems for timely reporting and measurement.

For unified control and governance, a specialized entity within each SCP district or municipal area under respective ULB with identical and integrated KPIs and management platform [C] to be established who in turn will collaborate with select Managed Services Providers (MSPs) as stand-alone OTT (Over The Top) player [D] or an integrated Communication Services Provider (CSP) as managed services model [E].

Comprehensive yet uniform guidelines and measureable metrics shall be issued for Central Information Platform, MSPs and CSPs such as:

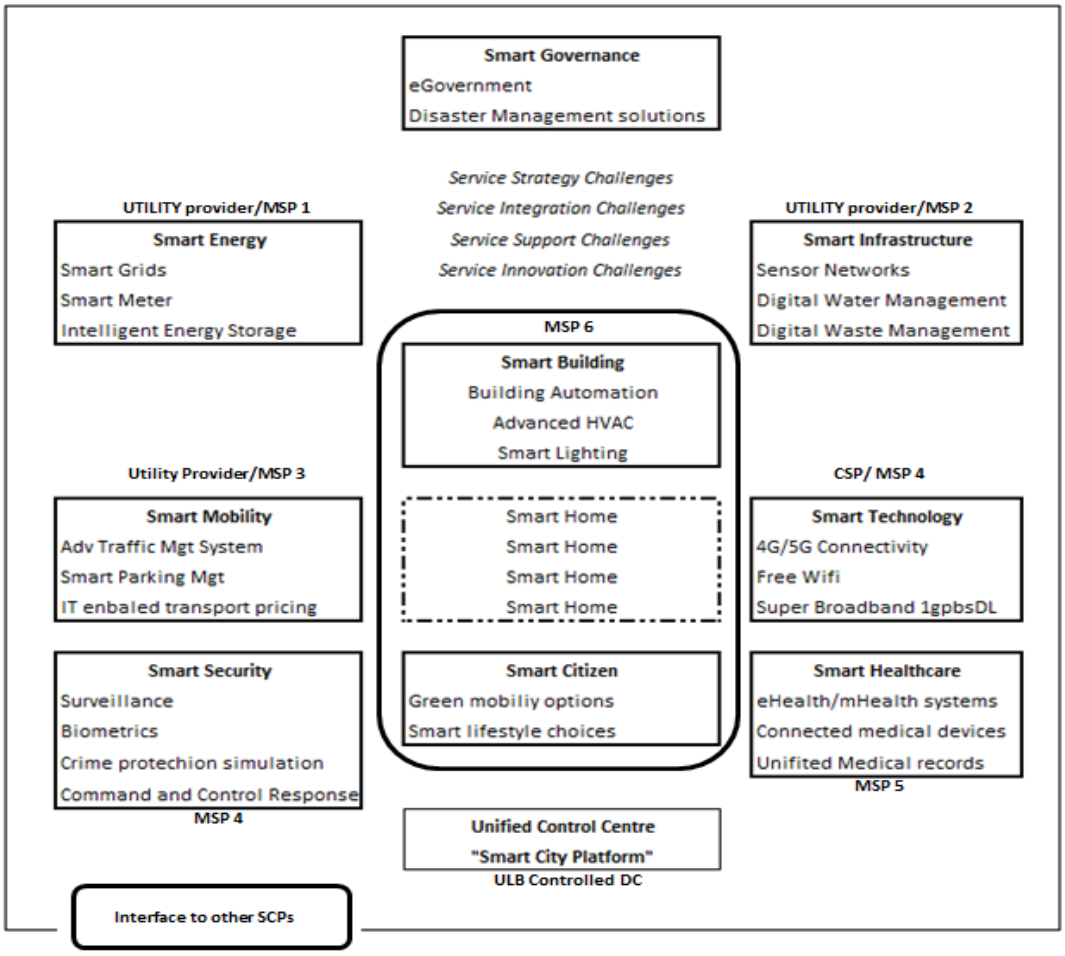
[C] Unified Control Center & information repository operational guidelines – Cloud Data Centre

[D] Operational guidelines & service performance metrics for Managed Services Providers

[E] Business level "ecosystem" models & service metrics for Communication Services Providers

KPIs and metrics at each level shall be addressed based on following key focus areas modeled in Fig 6.

FIGURE 6: MEASUREABLE METRICS TO ADDRESS KEY CHALLENGES IN SMART CITY PROJECTS



7. DISCUSSIONS

Key success factors for SCP implementation in India will largely depend upon the level of citizen participation and project management capabilities at ULB/district levels by adapting to measurable KPIs as propose earlier. As per reported news, initially 20 Indian cities will be subjected to Smart City implementation plan as per published list of Indian Government. Involvement of Public private participation, especially the managed services providers (MSPs), suggested model needs further dimension of "maturity level" similar or same as what is proposed by European Commission Initiative, Smart Cities and Communities. [Fig 7]. Such an approach shall provide good insight to those factors that will impact the SCP implementation and potential scalability and maturity of ICT infrastructure needed.

FIGURE 7: MEASURING SMART CITY PLANS: OBJECTIVE KPIS FOR GOVERNANCE AND CONTROL MATURITY

How to Measure Smart City Plans?

Factors describing the impact of smart city initiatives and potential scalability of ICT infrastructure serve as key efficiency monitors of current smart city plans.

Smart City Scoring Criteria* Global, 2013					
	1	2	3	4	5
Energy Efficiency	CO_2 emissions (<10%)	CO_2 emissions (10%–50%)	CO_2 emissions (>50%)	Zero CO_2 emissions	Innovating to Zero
Project Timeline	More than 20 Years	Up to 20 Years	Up to 15 years	Up to 10 years	Up to 5 years
Infrastructure Development	Lesser possibility to link existing infrastructure	Medium possibility to link existing infrastructure	High possibility of linking existing infrastructure	Upgrading existing infrastructure	Building new infrastructure
Technology Approach	Secure, fast, and wireless technology	Cloud-based services/ enterprise-grade platform	Open data central/ holistic platforms	Better assimilation of data through predictive technologies	Fully networked, open and expandable ICT architecture
Business Model	Only public/only private investment	Contractor/vendor model	Private consortiums	Public-private partnerships	Open collaboration
Governance Maturity	Smart city vision	Smart city strategy	Dedicated organization	Smart city leadership	Smart city consortium

*Scorecard based on Guidance Document published by European Commission Initiative, Smart Cities and Communities.
Source: Frost & Sullivan

From maturity level perspective, adopted Business model for public private partnership will play an accelerating role. As for as technology approach is concerned, it is highly desirable to have a seamless wireless infrastructure with robust information portability between managed services providers.

In UAE and Singapore, unique identification of every citizen is already enabled such Emirates ID in UAE and Singapore Citizenship ID in Singapore. Apparently, both are smart cards with built in chip for information storage and have been mandatory for all Government services. E-Governance initiative's in both countries are maturing rapidly with advanced information systems and connected citizens via m-governance mobile apps.

In India, Unique ID for citizens is issued as Aadhaar card which are not digitally capable but simple cards with citizenship information. Digital information of citizens and their participation and co-creation of services within smart city ecosystem is what India should aim for at least to start with in those 20 cities to evolve a robust and integrated smart city model which can be emulated in subsequent cities on pan-India basis.

8. FURTHER RESEARCH

In effect, Indian SCP maturity shall be fostered by reasonably good level of citizen partnership, social entrepreneurship business models, connected information ecosystems and KPI drive Managed Services providers' services. Guidelines and high level performance measures need to be established accordingly especially based on technology approach and service model maturity expected.

Since the concept of smart cities is still in nascent state globally, further research is required on how to evolve unified standards for smart communities, portability among SCPs, creating talented pool of workforce that are required to operate and maintain smart city services. Digitization of connected devices and services which will come from multiple sources can lead to aggregation of services by different Communication Services Providers.

Mobility among connected citizens and connected devices powered by apps such as what applications will be available to citizens on the move should also be an integral part of SCP rollout. It is advisable to call for closer public discussions among SCP areas so as to align the smart citizen's needs. Such research findings need to be concurred and included in the operational plans of SCPs.

Good research and conclusive recommendations are required to mitigate lack of collaboration and coordination among various public departments and to encourage adaptation of shared information tools among various SCP stakeholders. Further, best practices of international standards such as ISO 140001 Environmental safety or ISO or OHSAS standards need to be aligned with Smart City vision. Use of social media to proliferate smart city concept and measure level of public participation on co-creation of services provides ample scope for further research.

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