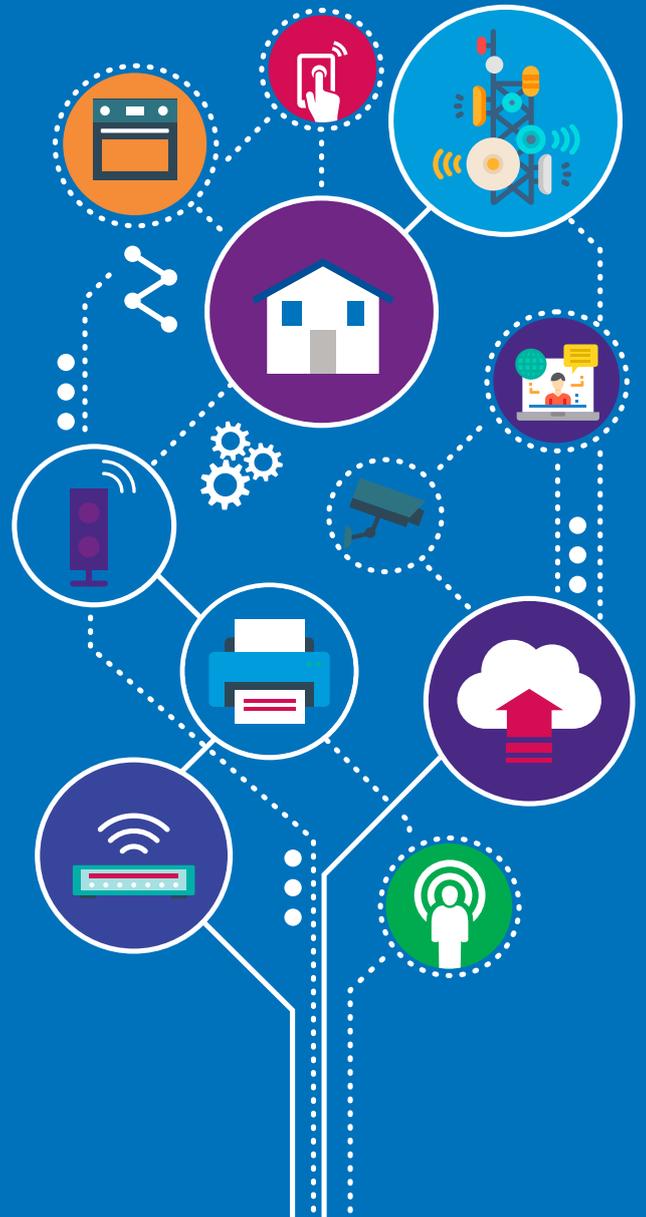


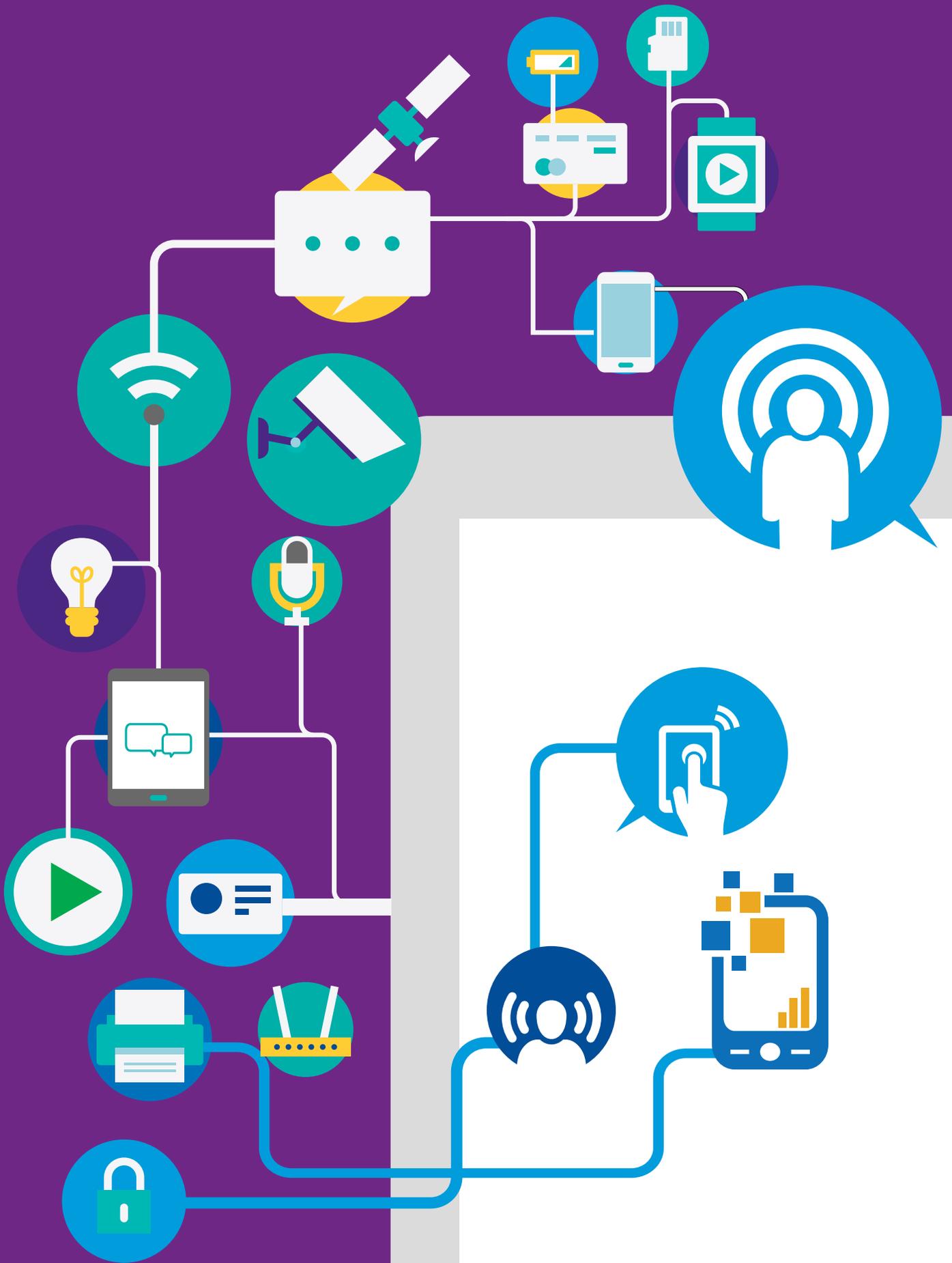
# Internet of Things in Smart cities



May 2019

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# KPMG in India foreword

With almost 75 billion connected devices projected to be utilised by 2025<sup>1</sup>, the demands of a connected world are clear. Development of a large ecosystem around Internet of Things comprising faster computing, advanced analytics, improved connectivity have provided a strong impetus to the growth of Internet of Things. The market is now poised to accept and adopt user centric solutions that Internet of Things enables. Internet of Things today can be considered an important aspect to smart solutions.

Adoption of smart solutions has gained a large traction in the 'Smart City' initiative across India. With a large volume of sensor-based infrastructure, citizen

centric solutions, big data analytics solutions being taken up in most smart cities, the Internet of Things ecosystem provides the right platform to manage and monitor modern urban landscapes.

Urban Local Bodies (ULBs) in India are developing their Smart City plans in alignment with Internet of Things to enable their overarching strategy and meet their operational and community challenges. The need to make our cities smarter and more liveable is increasingly seen as a vital way to improve their competitiveness and resilience in today's resource constrained world.

Internet of Things (IoT) is a key element of any smart solution and it brings forth opportunities for Smart Cities and innovative technology to lead the way.

However, success in implementing and sustaining smart cities will take more than slick applications, connected devices and advanced analytics; it will require a strong adherence to customer centricity, support in standardisation, development of regulatory frameworks and penetration of equitable digital dexterity.

1. Urban Growth, Ministry of Housing and Urban Affairs, Govt, May 2019



**Ramendra Verma**  
Partner and Head,  
Government Advisory

# Exhibitions India Group foreword

As governments world over focus upon economic development, a key component to their strategy entails inclusion of smart technologies into urban planning. No doubt, technology will be a driver for economic development in the future smart cities. The Internet of Things (IoT), a fundamental component of most smart cities, has, in particular, a potential economic value of \$4-11 trillion annually by 2025.

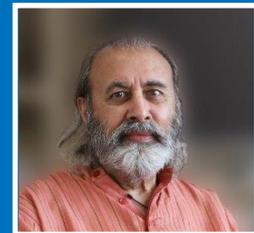
Currently, smart city initiatives make up the largest segment of Internet of Things projects, thanks to the hundreds of initiatives that vendors and municipal governments are driving around the world. Local governments are applying new layers of technology to their communities as they pursue 'Smart City' agendas, despite fears of what becomes of the data collected by those smart streetlights, traffic monitors, environmental sensors and mobile apps. The fear is not unfounded; however, benefits derived from implementing such projects outweigh everything else.

Like any multi-national enterprise, a smart city generates vast

quantities of data that needs to be stored and subsequently analysed. The level of complexity involved in the analysis of data surpasses human capability; therefore, machine learning and AI will be essential for the city administrators to extract and cross-reference insights from the different datasets involved. Administrators can use the findings to solve problems, automate processes, improve performance where necessary, and come up with new smart features and services.

Exhibitions India Group has collaborated with global consulting firm, KPMG International, to study Internet of Things in Smart Cities. The resultant paper, Internet of Things in Smart Cities, explains in depth the concept of Internet of Things (IoT), while exploring its growth enablers as well as the levers of its growth. It studies the business value of Internet of Things, key applications and impact on Smart Cities. Other subjects touched upon include, 'Dimensions of Internet of Things Adoption in Smart Cities', 'Need of Internet of Things Policy Framework for Smart Cities', and 'Global Progress on Internet of Things Policy

Framework'. A highly informative document, this is a cache of facts, figures, case studies, analysis, etc. that are crucial for understanding and identifying the areas that need to be focused upon or problems addressed to create a functioning Smart City.



**Prem Behl**  
Chairman Exhibitions  
India Group

# 1 Internet of Things: A definition



The era of hyper-connectedness is onto us, connecting not only people but also processes and things. Assets that we thought to be passive infrastructure, processes that we knew as outcome enablers

or workflows, are interacting actively with each other and people to create an interesting mesh of today's connected world. This network of things continuously connecting to sense, exchanging

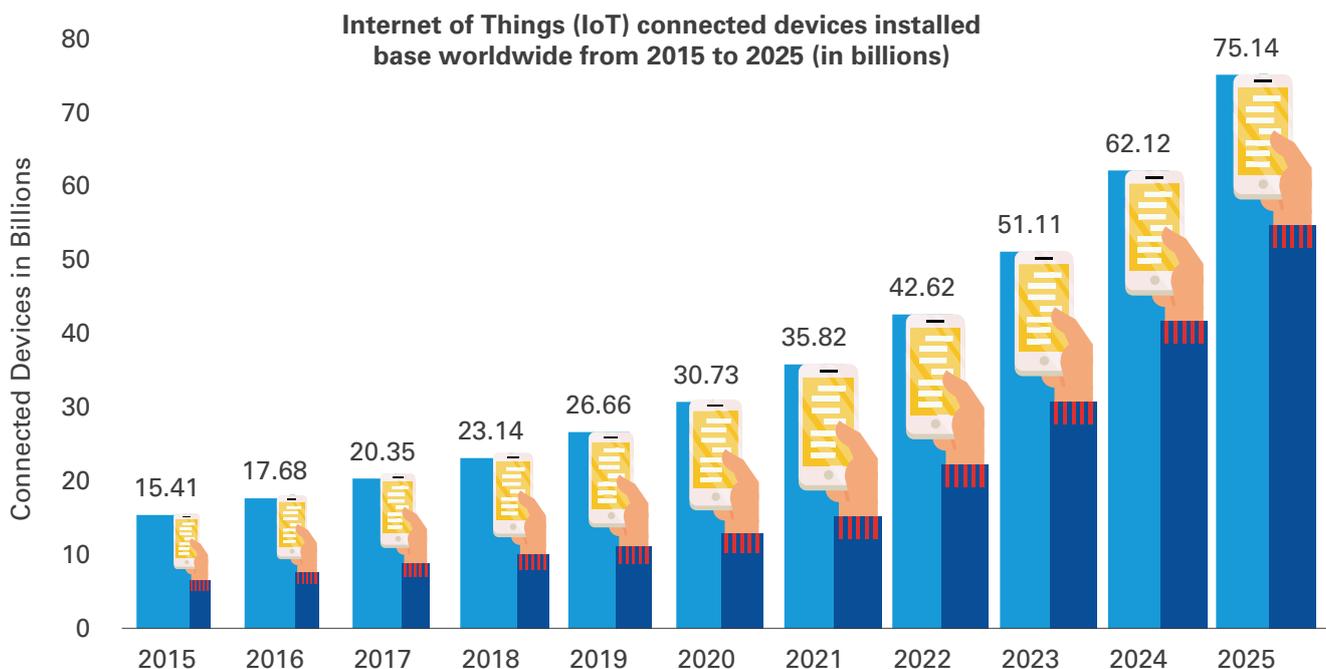
and utilising data is changing everyday life. Internet of Things (Internet of Things), the modern evolution of the internet, is evolving and allowing billions of devices to connect and interact.

## 1.1 The Internet of Things growth enablers

The Internet of Things market has grown leaps and bounds over the last decade. The ubiquity with which Internet of Things devices

are entering human lives, by 2020<sup>1</sup>, internet connected things will outnumber humans 4-to-1. The trend of Internet of Things adoption

can be extrapolated from statistics that have been gathered till date.



1. Leading the IoT, Gartner insights on how to lead in the connected world, Gartner, Mark Hung, 2017

2. Internet of Things (IoT) connected devices installed base worldwide from 2015 to 2025 (in billions), November 2016

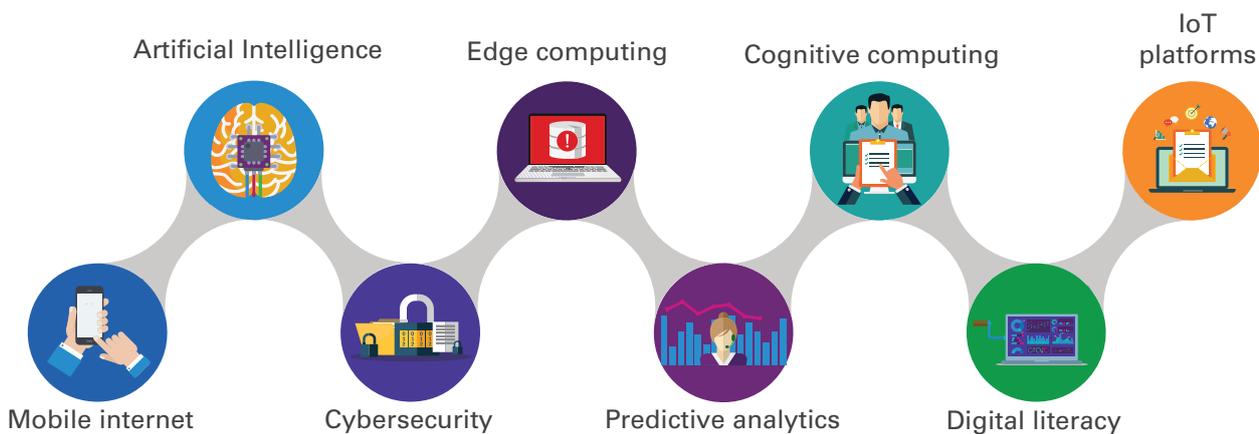
## 1.2 The levers of Internet of Things growth

Internet of Things has seen an exponential growth owing to the readiness of the ecosystem of

various other technologies resulting in building of use cases that impact human life. The economies of scale

of connected use cases has been enabled by the maturity of multiple technologies working in tandem.

### Emerging levers driving Internet of Things in Smart cities



Connectivity is the foundational lever for Internet of Things, allowing things to communicate continuously. Mobile internet has met the demands of bandwidth requirement along with speed. With the onset of 5G and various short ranged wireless technologies the footprint of Internet of Things grows.

Machine learning and artificial intelligence have been the basis of uptake of smart devices. The humungous amount of data that is collected by devices is easily converted to information and actions resulting in larger need of internet of things.

The volume, velocity and variety of data that can be handled securely with the onset of cybersecurity solutions has inculcated trust in the adoption of Internet of Things. Internet of Things exposes multiple

layers of data exchange which can be targeted for security breach. The availability of cybersecurity solutions at all layers – end point devices, communication, storage and interoperability of data has allowed growth in usage of Internet of Things.

The advent of edge computing has allowed faster decisions and reaction times for all 'things'. The reduction in response time due to edge computing has led to evolution of various use cases that require faster response like alerts on accidents, healthcare data, and surveillance. The ability to compute both in connected and unconnected environment has increased the demand for smart devices.

Industry and manufacturing are large markets for Internet of Things. Predictive analytics serve as a proactive tool to improve

efficiencies and productivity of a business. Predictive analytics play a major role as dependency on machines and devices increases. Improved algorithms and statistical techniques in this lever has supported growth of Internet of Things.

Cognitive computing allows enhanced experience for Internet of Things improving the intelligence of smart devices. The next economic impetus to Internet of Things shall be from machine intelligence allowing business model innovations on the fly.

Internet of Things platforms enable the delivery of Internet of Things applications and management of devices at rapidly reduced cost and time. The platforms provide a wide range of features to onboard devices, connect them securely and handle data exchanges.

## 2

# Business value of Internet of Things in smart cities

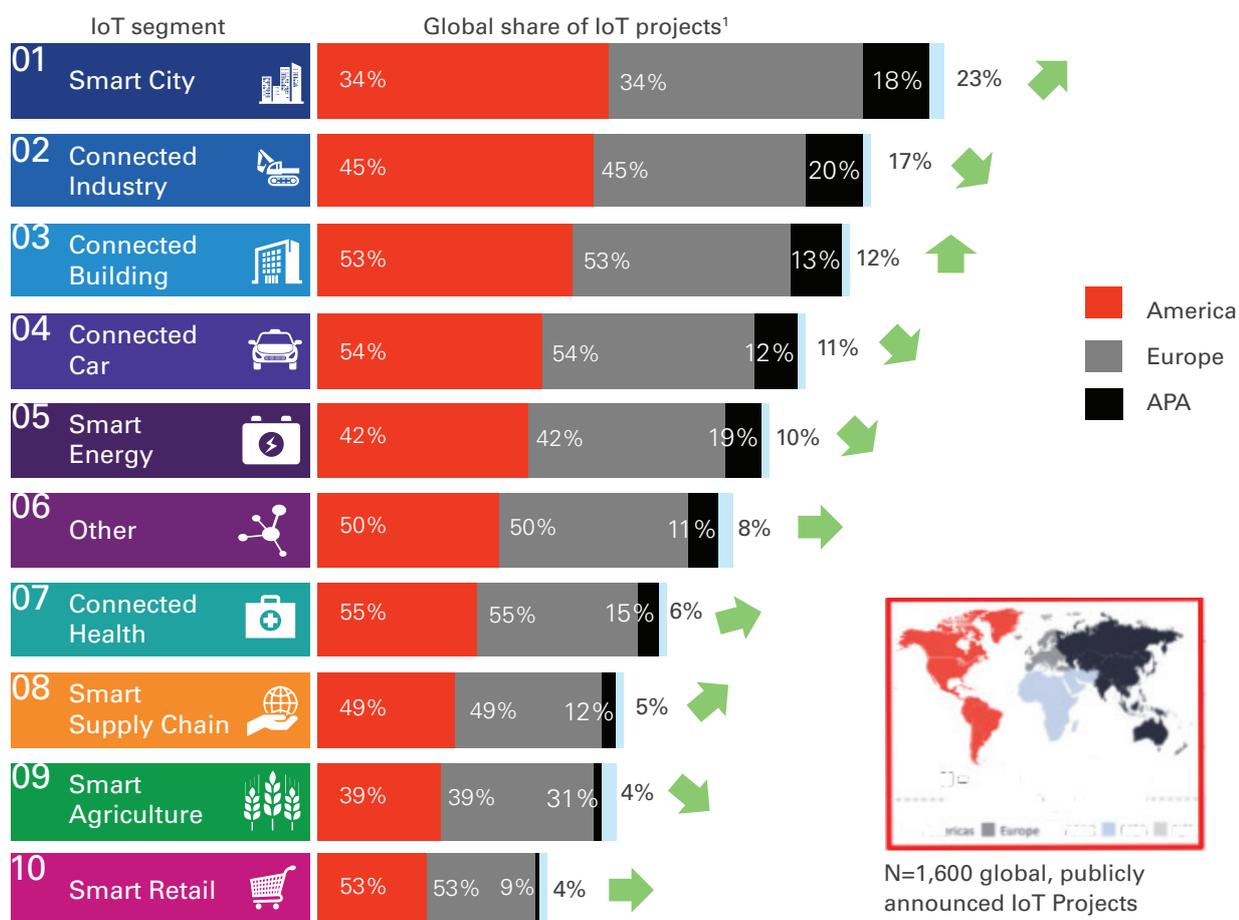


Smart cities have been one of the strongest enablers of Internet of Things. Cities today need to cater to dynamic demands of citizens. Many cities are competing to provide improved living conditions,

environmental sustenance and economic vitality. With the advent of technology and digitalisation there has been an evolution of an integrated approach to a smart urban ecosystem. This has led to a

huge marketplace and demand for Internet of Things. City planners and governing bodies are on a continuous lookout to innovate and adopt Internet of Things solutions that meet their town's priorities.

## Global trends too depict a large share of Internet of Things invested in Smart Cities<sup>1</sup>:



1. 5 Key Insights from 350 Smart City IoT Projects, IoT Analytics, Saverio, March 2019

According to the Zion Market Research report<sup>2</sup>, the global Internet of Things market, specific to smart cities was valued at around USD79.3 billion<sup>2</sup> in 2018 and is expected to reach approximately USD330.1 billion<sup>2</sup> by 2025, at a CAGR slightly above 22.6 per cent

between 2019 and 2025. Major factors driving growth of Internet of Things in the smart cities market are increasing number of government initiatives and Public Private Partnership (PPP) models for smart cities, improvements in the communication infrastructure

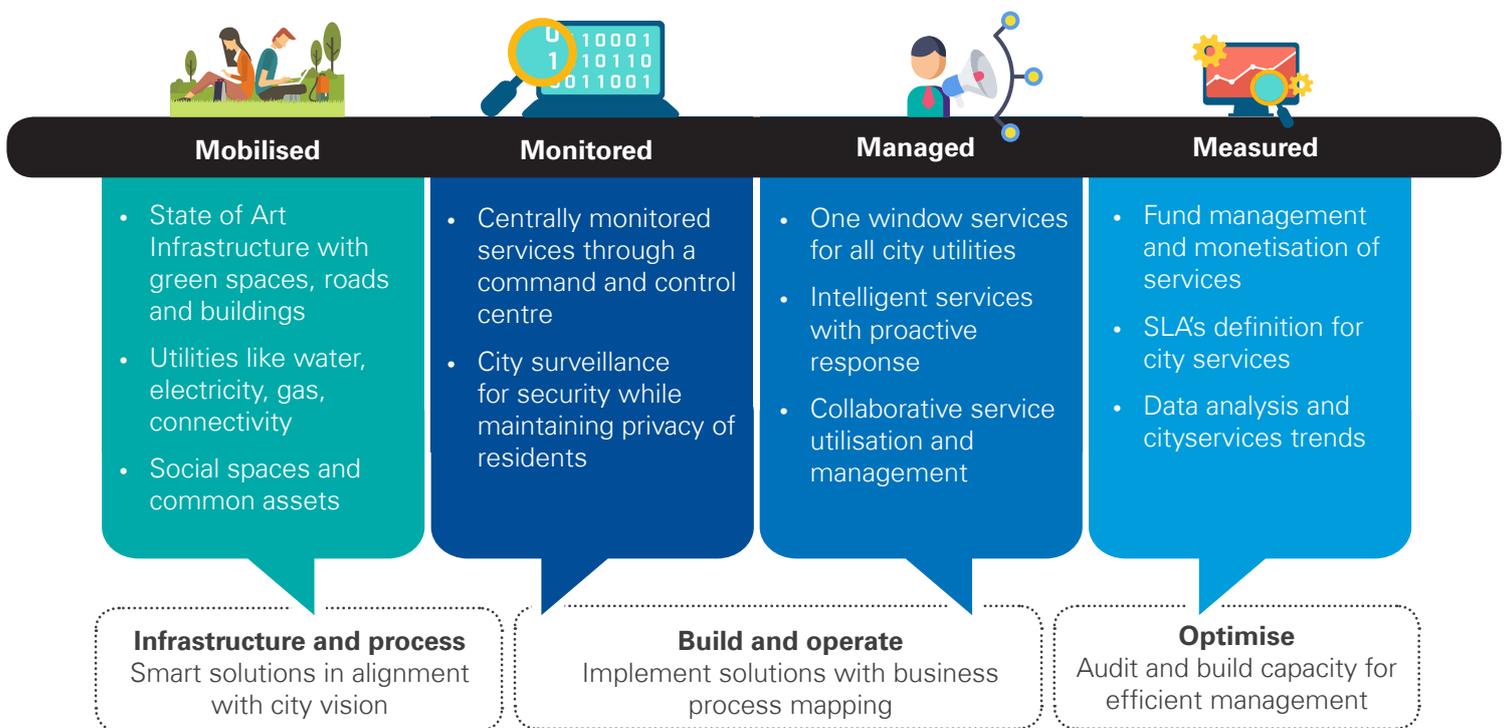
that are brought by Internet of Things and rising adoption of connected and smart technologies in smart cities' initiatives. However, the security and privacy issues related to Internet of Things may hinder Internet of Things in the smart cities market growth globally.

## 2.1 Impact of Internet of Things on smart cities

Cities today have earned to be called 'smart' owing to their capability to manage, monitor and measure city services and utilities.

With Internet of Things as the backbone, a smart city is able to comprehensively utilise information resources through a high degree of

interoperable integration providing the essential elements of urban development.



Internet of Things supports demands of all stakeholders of a city - citizens, governance bodies, implementers and operations support. The availability of Internet of Things today allows a city to manage their assets and monitor city life. The data collected helps to gain valuable insights on urban living and can help transform

livability parameters and future infrastructure.

The Institute of Electrical and Electronics Engineers (IEEE) Standard Associations, says of smart cities<sup>3</sup> "As world urbanisation continues to grow and the total population expected to double by 2050, there exists an increased demand for intelligent, sustainable

environments that reduce environmental impact and offer citizens a high quality life. A smart city brings together technology, government and society to enable a smart economy, smart mobility, a smart environment, smart people, smart living and smart governance".

2. Global IoT in Smart Cities Market Will Reach USD 330.1 Billion By 2025: Zion Market Research, Zion Market Research, April 2019

3. The Internet of Things and Smart Cities, IoT Evolution, Ajit Singh, April 2019.html

## 2.2 Key applications of Internet of Things in smart cities

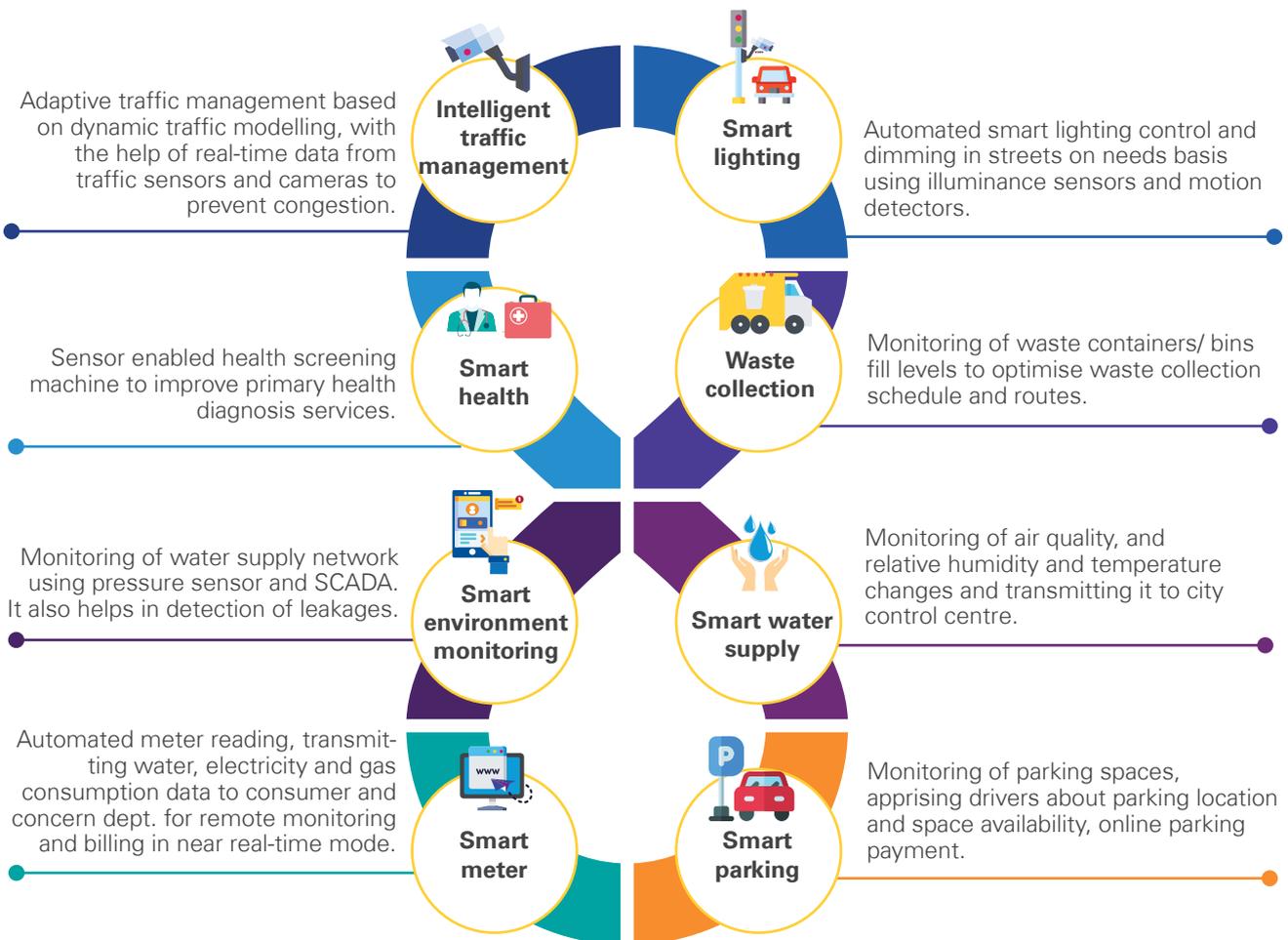
Since the emergence of various types of networks, Internet of Things has become one of the most important types of infrastructure in smart cities. By effective use of Internet of Things applications, a smart city can make the optimal use of public resources by increasing

quality of services and reducing the cost.

A key objective of Internet of Things in smart cities is to provide easy and unique access to public resources, so that better utilisation and optimisation of transport surveillance, water, power and maintenance of public areas can

be achieved. The concept of smart cities is being used to increase transparency and action been taken by local bodies in respect of public needs. There are few Internet of Things based applications which are being implemented in various smart cities as depicted in the figure below:

# Internet of Things

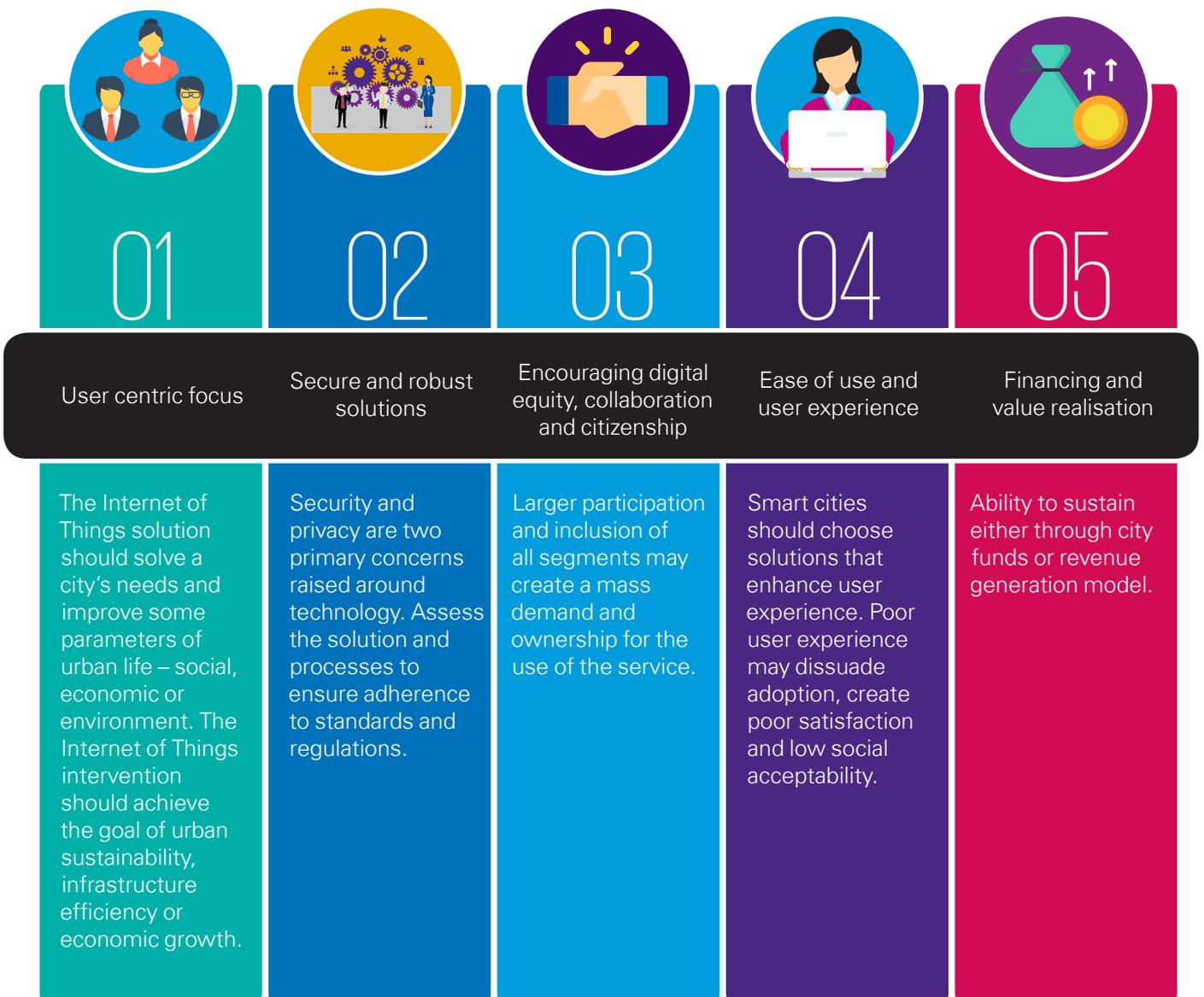


## 2.3 Dimensions of Internet of Things adoption in smart cities

The intent of making cities Internet of Things enabled is not about connecting things and services, rather it is a means to achieve a collaborative and participative community. Smart cities is about cities with efficient operations and

improved quality of life. The focus of city governing bodies should be to implement technology in the most non-intrusive, easy manner allowing the citizens to adopt it willingly. The success of Internet of Things adoption will depend not only on

technological factors but largely on human and societal factors. Internet of Things solutions for cities must be evaluated on the following key dimensions to ensure its early and smooth adoption:



## 3

# Need of Internet of Things policy framework for smart cities

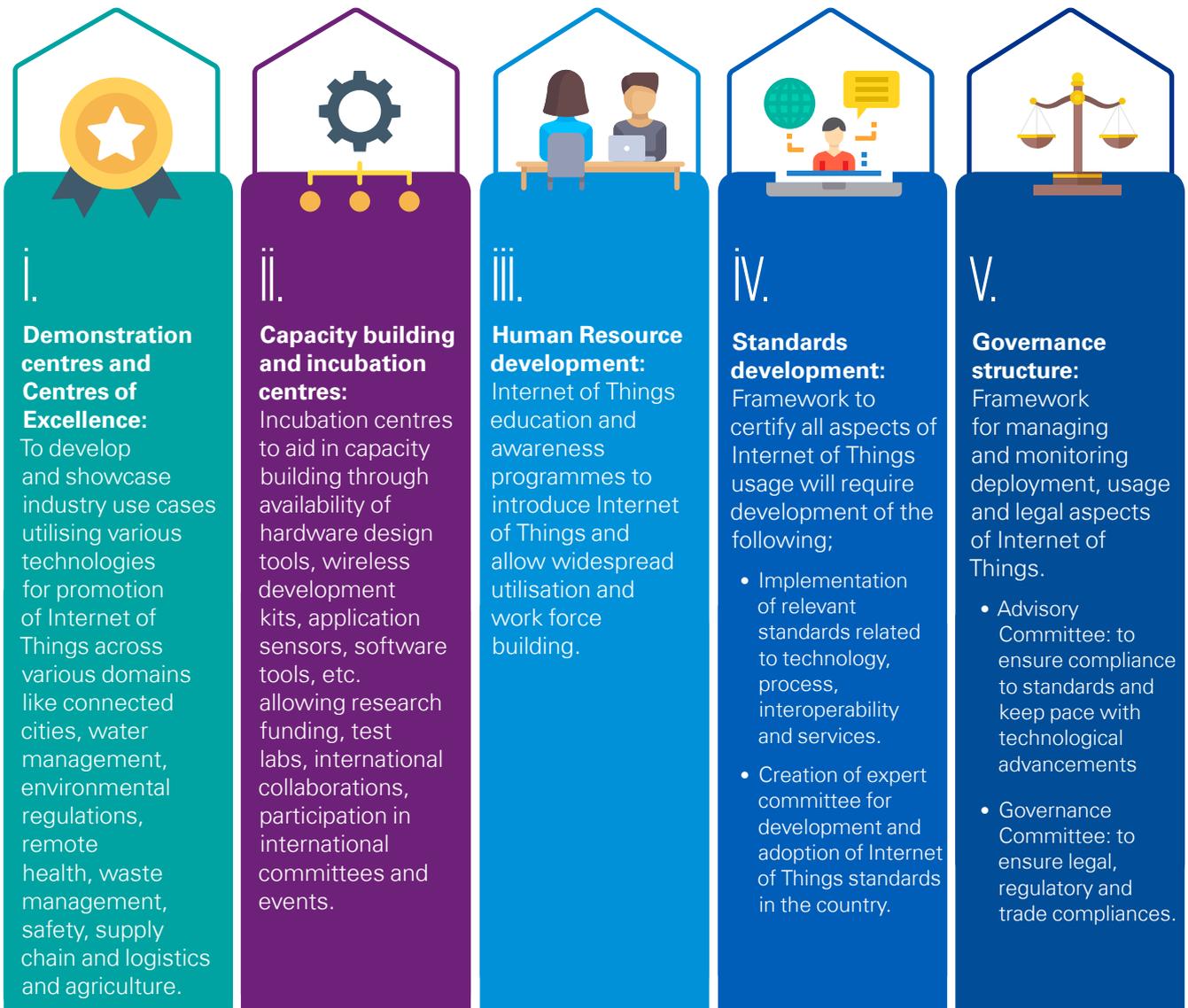


The city can drive Internet of Things initiatives as its potential benefits create enormous incentives. However, for the initiatives to be a success, steps have to be taken to accrue the benefits of a fully connected world. Innovative user centric Internet of Things solutions

require substantial support from the government in the form of comprehensive policies to aid and support development and widespread adoption of technology.

Internet of Things policy shall require a

multi-pronged approach to not only promote innovation but also subscribe to the tenets of standards, regulations and governance. The journey to a full-fledged policy needs to develop the following:



## 3.1 Global progress on Internet of Things policy framework

Globally countries have started to understand the importance of a framework to promote IoT as it enters every aspect of urbanisation and human life. Some countries have started developing strategies to support technologies like Internet of Things<sup>1</sup>:

### i. China



- a. 2010 – USD 117.2 million committed towards opening a national centre devoted to Internet of Things research and development.
- b. 2011 - 5 year plan for Development of the Internet of Things prepared by Ministry of Industry and Information Technology,
- c. 2013 - Programmes with focus on smart utilities and transportation introduced.
- d. 2013 – Preparation of National policy on the Internet of Things initiated

### iv. Singapore



- a. 2005 - 10-year plan to support ICT industry. Develop and deploy sensor networks and connectivity.
- b. 2014 - Smart Nation initiative for safe economic and societal benefits through increased adoption and unified use of technology
- c. 2015 –
  - USD 1.6 billion allocated for ‘Smart Nation’ initiative, to focus mainly on large-scale arrangements of smart city applications.
  - work on preparation of standards related to Internet of Things functioning

### ii. Germany



- a. Internet of Things an important focus area in Germany’s ‘Industry 4.0’ plan
- b. Smart factory technologies (like sensor based system to AI platforms) at a cost of USD 221 million through support from industry, academic, and government R&D.

### v. South Korea



- a. USD 5 billion planned to be invested in Internet of Things till 2020
- b. 2014 – Road ahead related to Internet of Things published

### vii. India



The Government of India took its first stride towards preparation of an Internet of Things policy framework in the year 2015. Implementation of Internet of Things in India has gained impetus through two major programmes – ‘Smart Cities’ initiative and ‘Digital India’ initiative.

The vision of the government is - “To develop connected and smart Internet of Things based system for our country’s Economy, Society, Environment and global needs.”

#### There are 4 main objectives covered under the draft policy:

- a. To create an Internet of Things industry worth USD15 billion by 2020<sup>2</sup>.
- b. Skill development and capacity building
- c. Research and Development.
- d. Development of Internet of Things products specific to Indians’ needs.
- e. network standards and domain-specific standards, to support the Smart Nation initiative and private-sector deployment of the technology.

### iii. Japan



- a. 2013 – Declaration made to make the country the “world’s most advanced IT nation,” and to utilise Internet of Things in the field of health, disaster management, safety, and planning.
- b. 2015 – Establishment of a group comprising of public-and private-sector organisations to provide assistance in developing and implementing specific Internet of Things technologies by 2018.

### vi. USA

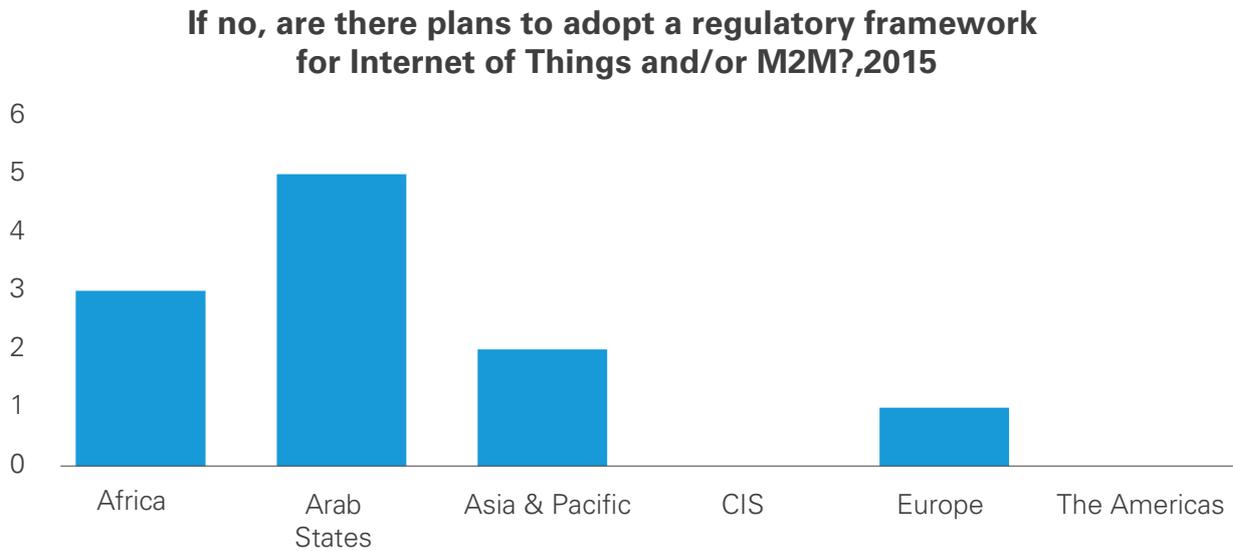
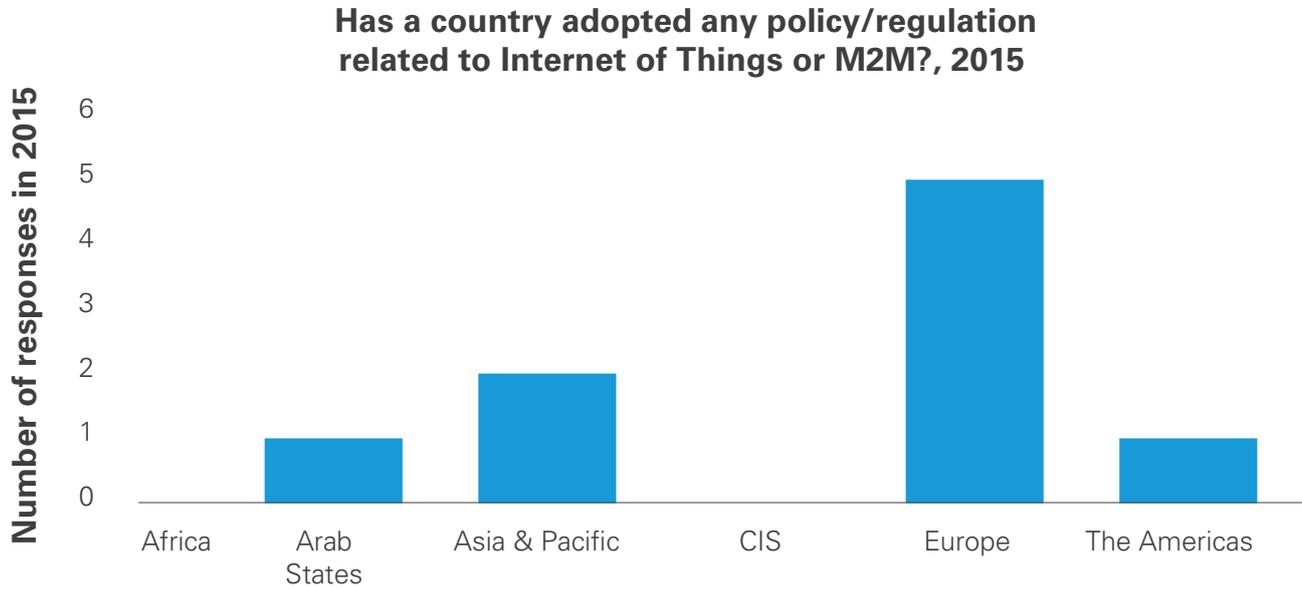


- a. 2015 – Launch of smart Cities initiative with USD 160 million
- b. Strategy for American Innovation released

1. Why Countries Need National Strategies for the Internet of Things, Centre for Data Innovation, Joshua New & Daniel Castro, December 2015

2. Draft Policy on Internet of Things, Ministry of Communication & Information Technology, GoI, 2015

Countries that have adopted policy/legislation/regulation related to Internet of Things or M2M in 2015<sup>3</sup> :



3. Policies and Regulations pertaining to IoT, ITU Academy



4

# Conclusion



Internet of Things in smart cities is related not only to use of robust technology but more so to the social aspect of ease of use, utility and digital equity which will allow larger acceptability and improved efficiencies in running a city. Digital ubiquity has spurred the influx of Internet of Things adoption.

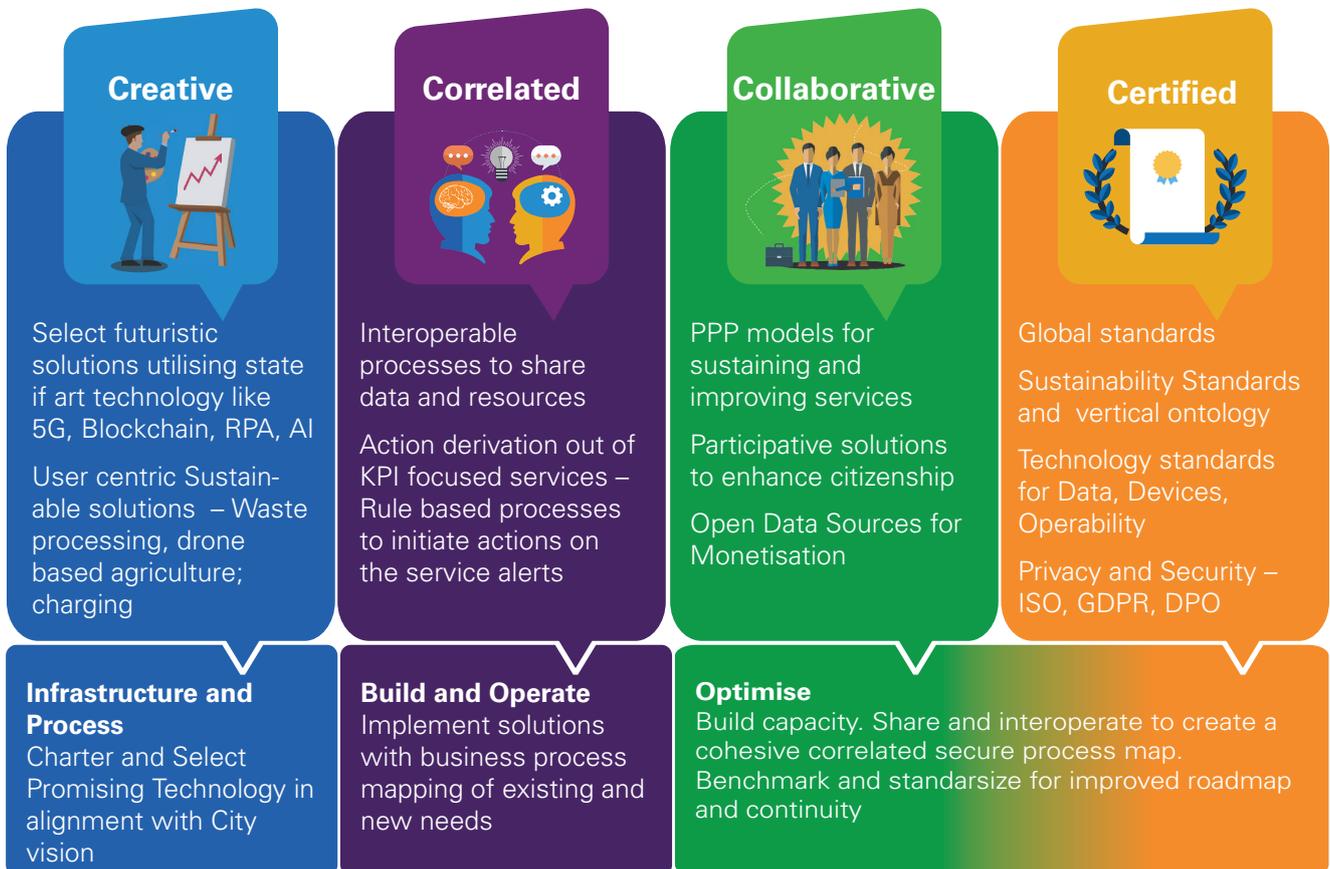
However for Internet of Things to be a success in smart city, it must adhere to the 4 C's principle,

- 1. Creative:** Be disruptively innovative to solve urban needs using state of art technology
- 2. Correlated:** Allow to work in tandem with various city services

creating a mesh of citizen needs rather than existing in silos

- 3. Collaborative:** Induce participative and equitable behavior allowing strong sense of ownership
- 4. Certified:** Secure, safe usage ensuring privacy of citizens and stakeholders

## Emerging levers driving Internet of Things in Smart cities

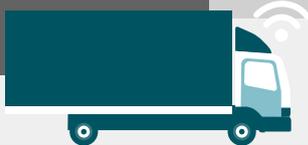
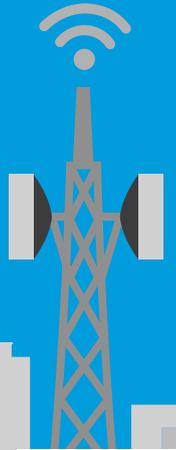
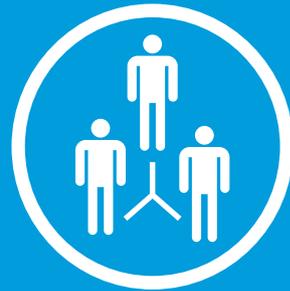


In summary, the way technological evolutions in connectivity, computing , chip development, analytics has helped Internet of

Things gain traction in smart cities, its sustenance and adoption in the urban landscape will need to be supported largely by human and

social factors like ease of use, need , equitable digital presence and privacy concerns.







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