



## Urban Informatics and Big Data Research

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**Deepa Bhasin, Palak Gupta, Abhishek Jain**  
(B Tech Final Year C.S.E)

Shobhit Institute of Engineering & Technology, Saharanpur,  
Uttar Pradesh, 247001 India.

### ABSTRACT:-

'Smart Cities' is a term that has gained traction in academia, business and government to describe cities that, on the one hand, are increasingly composed of and monitored by pervasive and ubiquitous computing. This paper focuses on how cities are being instrumented with digital devices and infrastructures that produce BIG DATA. Urban informatics plays a vital role in smart cities as it is the application of computers to the functioning of cities. In its narrower focus, it pertains to the ways in which computers are being embedded into cities as hardware and software so that the routine functions can be made more efficient. In its wider focus, it is concerned with the use of computers and communications to enable services to be delivered across many domains. The data volumes can be immense, larger than anything we have experienced in cities at present and these are currently referred to as 'big data'. The sections of the paper provide a critical reflection on the implications of BIG DATA, Urban Informatics and Smart Cities.

### KEYWORDS:-

Big Data, Smart cities, Urban Informatics, Pervasive & Ubiquitous Computing, Urban Analytics, Citizen Science, Hackers and Grassroots.

### INTRODUCTION:-

For the past two decades, urban analysts and theorists have been charting the evolution of cities during an era where information and communication technologies (ICTs) have been exerting a growing and pervasive influence on the nature and enhancement of urban infrastructure and everyday life. The history of urban informatics is however a little different.

It was never expected that the world would be using computers to understand systems that were composed of those same computers, except perhaps in systems remote from human functioning such as manufacturing. The current development of urban informatics relates to modeling and simulation and this is increasingly being called the 'science of cities'.

In this paper, the data explosion that has occurred over the past decade, the role of cities as

key sites in the production of such data. In particular, the analysis concentrates on the new phenomena of 'big data'. Big data are:

- huge in volume, consisting of terabytes or peta-bytes of data;
- high in velocity, being created in or near real-time;
- diverse in variety, being structured and unstructured in nature, and often temporally and spatially referenced;
- exhaustive in scope, striving to capture entire populations or systems ( $n = \text{all}$ ), or at least much larger sample sizes than would be employed in traditional, small data studies;
- fine-grained in resolution, aiming to be as detailed as possible, and uniquely indexical in identification;
- relational in nature, containing common fields that enable the conjoining of different data sets;

Flexible, holding the traits of extensionality (can add new fields easily) and scalability (can expand in size rapidly).

## **1. THE SMART CITIES MOVEMENT:**

### ***(a) Instrumenting the City***

The embedding of computers into cities to control physical systems has happened suddenly. For many years, supply chains have been gradually automated. Services too that are largely based on information have been delivered almost since the inception of the World Wide Web in the mid 1990s.

The developments have been accompanied by a new 'computerese' based on terms like 'big', 'smart', 'open' and so on which are used to describe everything from search to storage, access to information to software and thence to data.

There is a serious problem to these developments in that networked systems in cities do provide access to a wide range of services where information rather than the physicality of the service is important.

Location-based services were in the vanguard of this movement a decade or more ago. The companies that are dealing with networks like Cisco and Siemens that are making the running with the software companies like IBM providing the intelligence to make all this work. The problem in all this of course is that our attempts to build big systems in terms of ICT – have not been good.

### ***(b) Big Data: A New Focus on Time and Space***

A colloquial definition of big data is 'anything that won't fit into an Excel spreadsheet. Big data is not necessarily any better than little or small data but it is different in many ways.

For example, Population Census data that is based on 100 percent enumeration of the population is still the gold standard for finding out what is happening in cities but the

problem here is that the data is collected so infrequently (every 10 years) that it misses much of the action that we need to deal with. The rise of big data has led to some wild speculations.

Anderson, the editor of **Wired** magazine, in an article entitled “The end of theory.” He says “Correlation supersedes causation, and science can advance even without coherent models, unified theories, or really any mechanistic explanation at all.” That is a pretty dramatic statement and if we did not have any we thus have a challenge of education as much as one of experience.

#### ***(c) New Perceptions of What Cities Are***

The new technologies are changing our focus on the city from that based largely on space to one based on time. There is a tendency for those involved in smart cities that do not have a background in urban thinking and policy to see the city more in terms of technology and engineering than in terms of social structure.

Moreover the notion that urban problems are simple to solve should by now have been dispelled for the experience in everything from garden cities to green belts over the last 50 to 100 years. Problems in cities are ‘wicked’ in the terminology of Rittel and Webber (1973) in that they are more likely to get worse than better if you attempt to address them in directly obvious ways which seek simple solutions.

The irony of the current obsession with smart cities largely motivated by the biggest computer companies developing new markets for their software services is that because of the focus on technology.

#### ***(d) Urban Analytics***

In the 1960s with a concern for developing efficient responses to urgent incidents, operations research techniques began to be applied to the services that were charged with such response. Since the rise of big data and routine sensing, these kinds of models are being extended.

Urban analytics is focused on understanding patterns in big data and in this sense, a good deal of its focus lies on new ways of data mining, although to date, the discovery of new insights into the way cities function has been minimal. To an extent, urban analytics and urban operations research are currently expanding at a rapid rate due to the application of various computational techniques.

#### ***(e) Citizen Science***

In fact the web is now enabling its users to create data as well as engage in its manipulation. The idea of crowd-sourcing although in principle not directly based on a digital online world, has been massively enhanced by the growth of individual interactivity through the web.

The ability to collect data systematically by broadcasting questions across the web and then soliciting responses is in its infancy but there have been some impressive developments of

interesting data sets so far. In fact, it is in the discovery of new ideas that crowd-sourcing has produced some really impressive answers to well defined questions for which the power of the crowd and its ability to think laterally have made enormous contributions.

**(f) *Hackers and The Grassroots***

We could elaborate in considerable detail the way individuals are creating software through small programs called Apps and disseminating these either in free or open source form or for profit. It is hard to figure out how these are changing people's behaviors in the city and there are enormous social science challenges involved in developing such assessments.

It is clear for example that knowledge of prices for example for real estate in the city is now widely informed by online web sites and this must be altering demand and supply. Townsend (2013) implies that these kinds of development are as important to the idea of the smart city as the bigger software protocols and applications being developed by the major computer and communications companies and that these are much more people-centric in their impact and relevance.

**NEW OPPORTUNITIES FOR THE USE OF BIG DATA IN CITIES:-**

The rise of ICT and the spread of urbanization are arguable the two most important global trends at play across the world today. It is therefore an obvious opportunity to use such technologies to better understand urbanism as a way of life and to improve and attempt to resolve the many challenges that urban development entails in both developed and developing cities.

The fundamental opportunities and challenges of using big data in cities have not been sufficiently formalized. In particular, the necessary conditions for the general strategic application of big data in cities need to be spelled out and their limitations must also be, as much as possible, anticipated and clarified.

Thus today's '*Smart Cities*' movement needs to be placed in perspective: Are the achievements made possible by modern data and information technologies fundamentally different from what was possible in the past? To answer this questions the use of data in urban policy and management in light of the conceptual frameworks of engineering.

**CONCLUSION:-**

The notion of smart cities has gained much traction in recent years as a vision for stimulating and supporting innovation and economic growth, and providing sustainable and efficient urban management and development. One significant aspect of the smart cities concept is the production of sophisticated data analytics for understanding, monitoring, regulating and planning the city.

For citizens such data and its analysis offers insights into city life, aids everyday living and decision-making, and empowers alternative visions for city development. For governments, big data and integrated analysis and control centers offer more efficient and effective city management and regulation.

Over the next decade, the real-time city is likely to become a reality in many cities as urban

administrations seek to capitalize on new data streams and new commercial products are bought to market that help governments and citizens make sense of the city.

Given the role that such systems are likely to play in shaping urban governance there is a pressing need to interrogate the nature and production of urban big data, the composition and functioning of urban analytics and control centers, and the implications of technocratic, corporatized and real-time forms of governance.

This paper has provided some initial entry points, but wider synoptic overviews and in-depth empirical studies are required to examine existing and potential smart urbanism.

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