Chapter 6
Data, Information, Knowledge, Ways of Knowing, and Computational Intelligence in Smart Cities

ABSTRACT

The purpose of this chapter is to explore evolving understandings of data, information, and knowledge in smart cities including ways of knowing and computational intelligence. A review of the research literature is conducted in the context of smart cities. Issues, controversies, and problems emerging from the literature review are highlighted, contributing to formulation of a conceptual framework for urban life and the ambient with the evolving of data, information, and knowledge in smart cities. Using an exploratory case study approach combined with an explanatory correlational design, variables of interest are identified including information and communication technologies (ICTs), meaningfulness, and the use of visualizations while the nature of their relationships are assessed. Through the lens of emerging forms of data, information, and knowledge, efforts are made to inform understandings of smart, learning, and future cities while pointing to directions for research and practice.

1. INTRODUCTION

Schmitt (2015) develops the notion of "information cities" and employs "the metaphor of an urban metabolism" along with the notion of "the stocks and flows of a city related to its people", as well as to materials, water, energy, finances, health, density, and information. Iaconesi and Persico (2017) describe the idea of digital urban acupuncture (DUA) focusing on the flows of data and information in urban environments and "the resulting flows of knowledge, wisdom, emotion, and, in general, communication" in support of "insights about how to make interventions, creating a better, more inclusive, participatory, collaborative place." Bibri (2021) provides an extensive literature review of "sustainable cities and smart cities in terms of their integration as the leading global paradigm of urbanism" contributing to potentials

DOI: 10.4018/978-1-6684-4096-4.ch006

and understandings of "data-driven smart sustainable cities of the future." As such, this chapter is significant in that it explores data, information, knowledge, ways of knowing, and computational intelligence in the context of urban life and the ambient in smart cities, learning cities, and future cities, giving rise to the motivation for this work described in the following objectives.

Objectives: The main objectives of this chapter are to a) explore evolving understandings of data, information, and knowledge in the context of smart cities; b) formulate a conceptual framework for urban life and the ambient in relation to data, information, and knowledge in smart cities; and c) explore the nature of the relationship between variables associated with data, information, and knowledge as a way of learning more about evolving understandings of urban life and the ambient in smart cities. These objectives give rise to the main research question under exploration in this chapter – *How are data, information, and knowledge related in urban life in smart cities?*

2. BACKGROUND

Carrillo (2006) introduces the notion of knowledge cities, providing perspectives, examples, and approaches where chapter contributions pertain to the development of knowledge citizens, frameworks, and a taxonomy, to name a few. Batty (2013) advanced a new way of understanding cities, beyond just places and spaces, to systems and information flows across networks, and digital information. Schmitt (2015) proposed the notion of "information cities" emerging from the Future Cities Laboratory, ETH Zurich, where data, information, and knowledge are identified as the key components of information architecture for a city. Mattern (2019) claims that "our cities, past and present, mediate between various manifestations of intelligence" such as "legal codes and copper cables, inscriptions and imaginaries, algorithms and acoustics, public proclamations and system protocols." The United Nations Human Settlements Programme articulates the movement towards knowledge-based urban futures (UN-Habitat, 2022) in support of sustainable and equitable urbanization where responsible innovation, frontier technologies (e.g., drones, autonomous vehicles), and inclusion matter.

2.1 Definitions

Definitions from the research literature are provided for key terms used in this chapter.

- **Data:** Schmitt (2015) describes data "in the context of the city" as "the smallest entities of information" and "as values given to objects, expressions, functions, or properties."
- **Information:** According to Schmitt (2015), "information sets data in relation to each other" and "consists of data and connections." As such, information "is an important abstraction" and is referred to as "a virtual material, important for the information age and for the information society."
- **Knowledge:** Schmitt (2015) claims that knowledge emerges as "a result of connecting data and information."
- **Computational Intelligence:** While computational intelligence (CI) has been described (IEEE, 2021) as "the theory, design, application and development of biologically and linguistically motivated computational paradigms" drawing on the pillars of "neural networks, fuzzy systems and evolutionary computation" it is also said to be "an evolving field" which "encompasses comput-

Related Content

The Laptop Tracking Plan
Jessie Munks (2012). *Cases on Educational Technology Integration in Urban Schools (pp. 9-11).*
www.irma-international.org/chapter/laptop-tracking-plan/61698

Technology in the Special Education Classroom
Blanca Rodriguez (2012). *Cases on Educational Technology Integration in Urban Schools (pp. 29-33).*
www.irma-international.org/chapter/technology-special-education-classroom/61703

Exploring Ways to Use 3D Urban Models to Visualize Multi-Scalar Climate Change Data and Mitigation Change Models for e-Planning
John Danahy, Robert Wright, Jacob Mitchelland Rob Feick (2013). *International Journal of E-Planning Research (pp. 1-17).*
www.irma-international.org/article/exploring-ways-to-use-3d-urban-models-to-visualize-multi-scalar-climate-change-data-and-mitigation-change-models-for-e-planning/78888

Engaging Users for Participating in a European Data Collection Campaign with Smartphones
Marian Gogola, Eva Malichováand Martin Hudák (2022). *International Journal of E-Planning Research (pp. 1-19).*
www.irma-international.org/article/engaging-users-for-participating-in-a-european-data-collection-campaign-with-smartphones/309381

ICT and Regional Development in Australia
Wayne Pease, Michelle Roweand Lauretta Wright (2005). *Encyclopedia of Developing Regional Communities with Information and Communication Technology (pp. 348-352).*
www.irma-international.org/chapter/ict-regional-development-australia/11403