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Big Data Management and Urban Sustainability Analytics of Smart Governance

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ABSTRACT. I develop a conceptual framework based on a systematic and comprehensive literature review on urban sustainability analytics. Building my argument by drawing on data collected from ESI ThoughtLab, KPMG, Osborne Clarke, Phillips, and SmartCitiesWorld, I performed analyses and made estimates regarding most needed changes to improve smart cities' living environment. The data for this research were gathered via an online survey questionnaire and were analyzed through structural equation modeling on a sample of 4,800 respondents.

Keywords: big data analytics; urban; sustainability; smart governance

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1. Introduction

Smart cities constitute a cutting edge approach to urban advancement developed on the large-scale harnessing of big data-driven technologies and on the furthering of environmental sustainability, economic breakthrough, and groundbreaking innovation. (Nesti, 2020) Extensive information gathering, storage, and computing represent the principal constituent of big data-driven technologies that carries out the release, distribution, and recycle of smart city data in cyberspace. (Sun and Zhang, 2020) Big data computing and its technological infrastructure are instrumental in the strategy of refashioning urban spaces to attain exemplary sustainability. (Bibri and Krogstie, 2019) Smart technologies can further innovation in urban performance. (Aurigi and Odendaal, 2020)

2. Conceptual Framework and Literature Review

Smart city areas are administered by use of the algorithmic governance and systematization of dissimilarity (Ainsworth-Rowen, 2019; Ionescu, 2019; Kral et al., 2019; Lyakina et al., 2019; Rowland et al., 2020; Wingard, 2019) and designed with the assistance of specific approaches to smartness that impact the wide-ranging production of big data-driven space. (Dalton et al., 2020) Smart cities produce huge quantities of pivotal data which the government can harness to regulate cities more coherently. (Chamoso et al., 2020) Cities are networked by data connections and consequently remedies to urban issues have been reinforced by smart data technologies that articulate the continuous partnership between government and its citizens as a component of the democratic process. (da Silva and Fernandes, 2020) The expansion of digital technologies and real-time collected information strengthens smart urban governance (Drennan-Stevenson, 2019; Kenrick et al., 2019; Lingchen, 2019; Mihăilă, 2019; Pilkington, 2018; Tuyls and Pera, 2019), building up a robust urban big data-based technological environment. (Ranchod, 2020) Smart data technologies necessitate stepping up with the assistance of open and consistent and compatible data, reliable management and guiding principles, and government command and interactivity by deploying certain resources. (Rice and Martin, 2020)

3. Methodology and Empirical Analysis

Building my argument by drawing on data collected from ESI ThoughtLab, KPMG, Osborne Clarke, Phillips, and SmartCitiesWorld, I performed analyses and made estimates regarding most needed changes to improve smart cities' living environment. The data for this research were gathered via an online survey questionnaire and were analyzed through structural equation modeling on a sample of 4,800 respondents.

4. Results and Discussion

The cropping up of smart governance has advanced the Internet as a technologically connected network of things. (Silva et al., 2020) Internet of Things is pivotal in setting up a low-carbon wireless sensor network for enhancing sensor-based interaction in smart cities. (Chithaluru et al., 2020) Widespread harnessing of technology in smart cities brings about important governance concerns. (Bina et al., 2020) Smart city security technologies may impact standard policing and urban planning operations. (Laufs et al., 2020) Software systems intelligence and intricacy have been growingly consolidating specific characteristics that bolster essential strategic operations management in smart cities. (Hachem et al., 2020) (Tables 1–7)

Table 1 Most needed changes to improve smart cities' living environment (%)

Availability of affordable housing	54
Reducing traffic congestion and improving transport/mobility	79
Improvement of recycling/waste management and infrastructure for recyclable waste collection	77
Availability of green spaces/parks	75
A living environment that is more accommodating to elderly and disabled residents	66
Reducing pollution	77
Reducing the carbon footprint	76
Urban redevelopment	67

Sources: KPMG; my survey among 4,800 individuals conducted February 2020.

Table 2 How cities are planning to fund their smart city programs (%)

Philanthropic support	61
Public–private partnerships	65
Department budgets	59
Pay-for-success	58
Revenue share financing	56
As a service financing	55
Concession financing	54
Consumption-based financing	52
State support	38
User fees	33
Sales and leaseback	31
Franchise or shared revenue model	29
Federal support	29
Debt	26

Sources: ESI ThoughtLab; my survey among 4,800 individuals conducted February 2020.

Table 3 Key actions to improve smart cities' healthcare system (%)

Improve preventative healthcare (such as check-ups, immunizations, health education)	69
Strengthen public-private cooperation on healthcare initiatives and services	65
Improve predictive healthcare applications that utilize data analytics and artificial intelligence to improve diagnoses and treatment	78
Improve electronic record sharing and interoperability between primary and secondary healthcare providers	75
Build more clinics and hospitals	68
Invest in technology for remote monitoring of elderly and long-term care patients	76
Strengthen infectious disease control and prevention	68
Encourage citizens' use of health technology including mobile devices and apps	79

Sources: KPMG; my survey among 4,800 individuals conducted February 2020.

Table 4 What benefits is your city now gaining from its smart city investments? (%)

Attract residents and tourists	44
Better public services	59
Attract business and private investment	63
Safety and security	58
Economic competitiveness	69
Ability to adapt and innovate	72
Productivity of city workers	74
Productivity of businesses and residents	76
Additional revenue	69
Easier commute and access to services	44

Sources: ESI ThoughtLab; my survey among 4,800 individuals conducted February 2020.

Table 5 What are the greatest obstacles to the roll-out of smart technology in the country where you are located? (%)

	Smart meters	Energy storage	Building control systems	Intelligent transport systems
Lack of consumer demand for solutions	21	6	19	5
Lack of investment/finance	4	15	10	14
Lack of incentives to encourage investment	4	14	12	13
Regulatory framework not fit for purpose	12	7	6	6
Lack of proven/adequate technology	1	23	1	5
Creates security/privacy issues	18	1	6	1
Outdated legacy urban infrastructure	2	1	5	12
Lack of conversation and agreement between local government departments	3	2	4	3
Lack of technology standards	3	1	2	3

Sources: Osborne Clarke; my survey among 4,800 individuals conducted February 2020.

Table 6 Which stakeholder do you turn to for advice and guidance with regards to smart city implementation? (%)

Businesses	27
City leaders	19
Private companies (e.g. utilities)	15
Citizens	12
Planners	11
Consortiums	11
NGOs	4
Other	1

Sources: SmartCitiesWorld; Phillips; my survey among 4,800 individuals conducted February 2020.

Table 7 To what extent do you agree that PPP (public/private) JV structures are likely to be the most efficient way to fund smart technology national infrastructure programs? (%)

Strongly agree	29
Agree	50
Disagree	15
Strongly disagree	6

Sources: Osborne Clarke; my survey among 4,800 individuals conducted February 2020.

5. Conclusions and Implications

A lot of cities are improving quality and operations of urban services by being digitalized, automated, and smart. (Kumar et al., 2020) Various kinds of artificial intelligence can be advanced by innovations in big data processing and set out by the configuration of smart spaces. (Lynch and Del Casino Jr., 2020) Huge volumes of heterogeneous data must be processed, handled, and monitored in a convenient and streamlined fashion. (Jararweh et al., 2020) Trust constitutes an agent in shaping the link between approach, subjective norm, and citizens' behavioral drive in smart cities. (Chang et al., 2020)

Survey method

The interviews were conducted online and data were weighted by five variables (age, race/ethnicity, gender, education, and geographic region) using the Census Bureau's American Community Survey to reflect reliably and accurately the demographic composition of the United States. Sampling errors and test of statistical significance take into account the effect of weighting. Stratified sampling methods were used and weights were trimmed not to exceed 3. Average margins of error, at the 95% confidence level, are +/-2%. For tabulation purposes, percentage points are rounded to the nearest whole number. The precision of the online polls was measured using a Bayesian credibility interval. An Internet-based survey software program was utilized for the delivery and collection of responses.

Data and materials availability

All research mentioned has been published and data is available from respective outlets.

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Author contributions

The author confirms being the sole contributor of this work and approved it for publication.

Conflict of interest statement

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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