Editorial Preface

Special Issue on Models and Strategies Toward Planning and Developing Smart Cities

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INTRODUCTION

In this special issue, we feature six contributions to discuss some of the different smart city design models. Four of these contributions are based on the preliminary papers presented at the 17th International Conference on Digital Government Research, and two other original papers were submitted in response to the special issue's open call. Featuring and sharing these papers is intended to benefit the audience in E-Planning research and the practitioner community, to better design and plan the development of smart cities, cater to smart citizens and evolve smart government. The special issue includes theoretical and practical case studies as well as position papers that demonstrate and advocate various design dimensions and models.

SMART CITIES

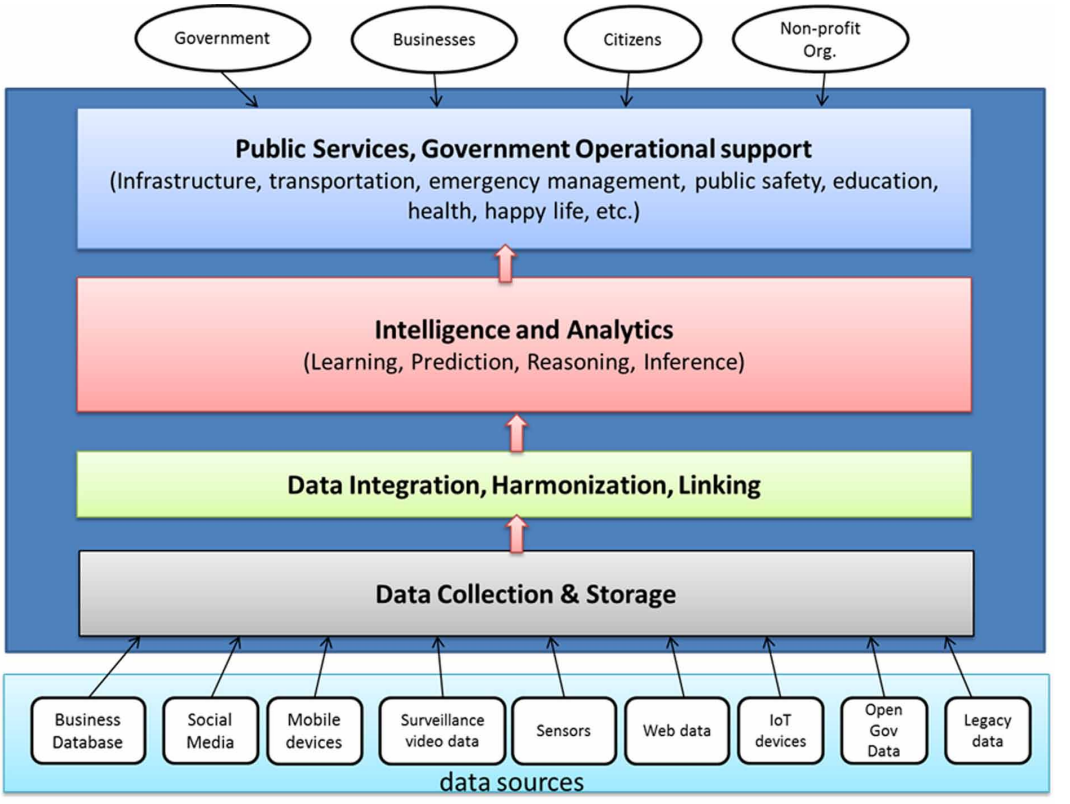
There exist many definitions for smart city, such as "A smart city is a city seeking to address public issues via ICT-based solutions on the basis of a multi-stakeholder, municipally based partnership," (Manville et al., 2014). Another definition characterizes a smart city in that it "integrates hardware, software and network technologies in order to connect seven critical city infrastructure components and services: city administration, education, healthcare, public safety, real estate, transportation and utilities" (Washburn & Sindhu, 2009). In the urban planning context, "smart city" entails strategic policy directions that governments take in order to achieve sustainable development, economic growth, better quality of life and simply create happiness (Albino et al., 2015), while others emphasize the importance of open innovation and user engagement (Paskaleva 2011). Yet another approach stresses citizen-centric and citizen-driven innovations (Albino et al., 2015; Jung-hoon Lee & Hancock, 2012). IBM's "smarter cities" concept also "emphasizes the need to better apply advanced information technology, analytics and systems thinking to develop a more citizen-centric approach to services, calling for the smart city focus to shift from appealing to mass audiences to appealing to individual citizens *en masse*, and to shift from standardized services to more tailored and contextually intelligent services" (IBM 2010).

The common features mentioned in these definitions include: interconnected technology, data-driven, innovative policy decision support, and intelligent public service provisions. Based on these features, we could design a generic architecture of the smart city platform that includes the following components: (1) A service layer that helps governments to make better design decisions on the city's various infrastructure elements, and to provide more intelligent social and human services; (2), an intelligence layer that creates smart and innovative solutions for services by transforming patterns and behaviors from data sets into knowledge, insights and predictions to support end user services; (3) an interconnection, integration, linking, and communication layer that facilitates the data integration, sharing, and communication among disparate systems; and (4) a data collection layer that collects and stores the data from multiple sources, including but not limited to the city systems, sensors, IoT devices, as well as human sensors (smart devices or social media). Figure 1 shows the smart city architecture with these major components.

SMART CITY DESIGN MODELS

In each layer of the generic smart city architecture shown in figure 1, alternative smart city design models can be considered. Depending on whether the stakeholders' (end user) layer is deeply involved in the smart city initiatives or not, we can define different types of smart city governance models. These range from a government centric smart city model to a participatory model where citizens provide feedback and comments on the city design, resulting in a collaborative and co-production

Figure 1. Smart city architecture



governance model where the citizens are integral parts of the decision-making loop for designing the smart cities.

The Services Layer defines the target area for a smart city model. This service dimension can define a smart city model, ranging from one that focuses on the government's internal optimization and public management processes to another model that improves the citizen-facing public service delivery to a smart regional model that emphasizes the provision of inter-city services that connect or share services of different cities.

The Intelligence and Analytics Layer defines the dimension to determine a smart city design model that consists of a basic descriptive model, an advanced model that provides more insights and understanding of the citizens' needs and behavior patterns, and finally an intelligent model that can learn from available data sets and predict citizen needs and support their actions according to the context.

The Data Integration, Harmonization and Linking Layer can generate variations of the smart city model, ranging from a siloed city model to a federated collaboration model among agencies to a fully connected smart city model, which allows seamless data flows between different systems.

The Data Collection and Storage Layer defines the dimension that determines whether a smart city model is operating on closed data sets, partially open data sets, or open data sets. This dimension can also define the standardization level of the data publications, ranging from non-standard proprietary data-based models to partially or fully standardized open data formats.

In this special issue, we feature six contributions to discuss some of the different smart city models shown in Table 1. Four of these contributions are based on the preliminary papers presented at the 17th International Conference on Digital Government Research, and two other original papers were submitted in response to the special issue's open call. Featuring and sharing these papers is intended to benefit the audience in E-Planning research and the practitioner community, to better design and plan the development of smart cities, cater to smart citizens and evolve smart government. The special issue includes theoretical and practical case studies as well as position papers that demonstrate and advocate various models listed in Table 1. In the following section, we briefly summarize the main smart city approaches and models of each article.

Table 1. Smart city models according to component level dimension

Design Dimension	Continuum of Smart City Models
Stakeholders/Governance	• Government-centric smart city model • Participatory model • Collaborative/co-production governance model
Target Services	• Internal service model • Public service model • Inter-agency service model • Inter-city service model
Intelligence/Analytics	• Descriptive city model • Insight-based city model • Predictive city model
Data Integration	• Siloed City model • Federated collaboration model • Fully connected model
Data Collection/Sharing	• Closed data city model • Partially open data city model • Open data model

SMART CITY DESIGN MODELS AND APPROACHES

Smart City Governance Model Analysis

In the article entitled "Governance in Smart Cities. A comparison of Practitioners' Perceptions and Prior Research," Bolivar analyzes the literature to identify different dimensions for fine-grained smart governance model categories. The relevant dimensions associated with smart cities include steering, boundary conditions, alignment, dependency, and local government role. Findings show that there are differences between empirical experiences and theoretical literature studies. The dimensions of governance are used in empirical experiences more than in theoretical studies, and the leading role of local governments in smart cities is much greater, deviating from the literature studies where they should play the role of "co-producer." These mismatches between the theoretical smart city governance models and those used in practice call for policymakers to carefully define their strategies for the effective involvement of stakeholders in the co-production of smart initiatives, and demand clear justifications for the role of governments in smart cities. This work is relevant to the stakeholders' layered smart city models in Table 1, especially the government-centric smart city model vs. the participatory or co-production models.

Smart Participation Model Design by Data Analytics

Boukchina et al. present a Natural Language Processing (NLP) analytics approach to process user-generated comments more efficiently. This is a model that is supposed to promote the citizen participation in service provisioning, utilizing data analytics to identify the major topics in the comments. Future work needs to show how this smart city analytics model, using Natural Language Processing, actually affects the citizen participation. This work proposes to design a smart city model by enhancing the capability of the Intelligence and Analytics dimension in Table 1.

Smart Policy Design by Sharing and Decision Support

Chen et al. present a smart policy decision design model by employing a Group Decision Support System (GDSS). Case studies are conducted to show that the smart city model for designing more efficient emergency management can utilize advanced computer-supported group decision models (e.g., simulations) to explore and recommend policies for emergency mitigation and city resilience. This study advocates the features provided by a GDSS, e.g., sharing of data related to managing and mitigating emergencies and sharing decision models, as key success factors. The relevant smart city design models include in the dimensions of data integration (Federated collaboration model) and intelligence (Predictive city model) as well as the government internal optimization model (i.e. Internal service model) in the service dimension in Table 1.

Smart Justice Model Design by Data Integration

The article entitled "Legal Logistics - A Framework to Unify Data Centric Services for Smart and Open Justice," by Netten et al. presents a smart city framework, called Legal Logistics, to provide a unified view towards the vision of a smart and open justice system. This study argues for a smart city design by data integration, unifying and embodying different data-centric services that exploit available and relevant data for supporting and enhancing the legitimacy and efficiency of the criminal justice system. A unified view of data-centric services in the legal context can enable better streamlined innovations in legal systems, allow innovation by utilizing integrated data sets to gain new insights into the functioning and budgetary needs of the Dutch legal system. This work falls into the smart city model design by data integration in Table 1.

Smart InterCity Model by Service Integration

In this paper, Soe presents a cross-border service approach for ubiquitous services across cities. Each smart city development may result in silos and fragmentation in terms of services unless there are

seamless flows of data and services between cities. It proposes the Urban Operating System that is based on the partnership among different cities and that utilizes open software and platform standard solutions. The case study of the Twin-City Living Lab is discussed to show how a joint cross-border pilot project that was implemented in the cities Tallinn and Helsinki can guide two cities in different countries towards a shared identity, can help to harmonize data, and provides means for co-development and in trial legislation. This is a proposal for a smart city design by using the inter-city service model and the fully connected smart city model, according to the data integration dimension and target service dimension in Table 1.

Designing Smart Regions by Aligning Strategies and Resource Harmonization

Priano et al. present the paper "Smart Region, Smart Island, Smart City Model, Smart Destination, Smart Territory, Level of smartization." It shows that smart region design requires understanding characteristics and seeking common patterns. The authors express a warning that separate smart city models do not necessarily combine linearly to result in a smart region. To create a successful smart regional model, they propose an approach of smart island territories, by harmonizing and optimizing the available resources and by providing for smart planning that is more orderly, uniform and efficient. This design proposal falls into the inter-city service model in the service domain and they advocate a fully connected model in terms of the data integration dimension in Table 1.

CONCLUSION

We have organized the special issue topics according to the generic smart city layered architecture, shown in Figure 1 and Table 1. The core dependency of the smart city models on Information and Communication Technology (ICT) prompted us to analyze the proposed framework and the different smart city models according to this smart city platform architectural component dimensions. As shown in Table 1, the smart city models can vary in the continuum of each dimension and there is a whole gamut of different design dimensions. The collection of topics and design approaches proposed and verified in this special issue provides a basis for extending these potential smart city design models. We hope that the contributions in this special issue will provide those involved in smart city planning and design with an understanding of the theoretical possibilities, and with empirical case study support for alternative smart city models, solutions and approaches.

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