

The Role of Digital Technologies in Promoting Smart City Governance: The Case of SmartGov

Research in progress

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ABSTRACT¹

This paper presents the analysis of the SmartGov project as a case of smart technologies application, such as expert-based Fuzzy Cognitive Maps, social media applications and open data, to promote citizen engagement and support decision-making. The objective of this paper is to analyze the role of digital technologies as inputs to achieve smart city governance. The main results are illustrated in a framework that combines the smart city governance elements in a real case description.

CCS CONCEPTS

• Applied computing~E-government

KEYWORDS

Smart Governance, Citizen Centricity, data-driven decision-making, Smart Cities, ICT-enabled governance, SmartGov

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1 INTRODUCTION

Smart city is characterized by the efforts of governments to increase the quality of life in the cities. “The smart city field has come to a uniform definition, which deals with innovation (not necessarily but mainly ICT-based) in the urban space that aims to enhance the 6 city dimensions (people, economy, government, mobility, living and environment)” [1, p.12].

In order to address the challenges of smart cities new and innovative forms of governance are needed, with an special role in connecting initiatives between governments and citizens and

keeping the decision processes transparent [2, 3, 4]. ICT-based tools, such as social media applications and open data portals, can be factors that support the development of new governance models for smart cities, as well as increasing citizen engagement.

The importance of citizen engagement and co-production has been emphasized in projects and studies, addressing aspects such as the change in the relationship between citizens and government through a single community engagement platform (WeGovNow²) and the role of citizens as co-creators of services and policies and how it can enhance its innovation and effectiveness and lead to new forms collaboration [5]. Also, in smart cities domain, literature have been addressing the importance of data for smart governance [6], the role of e-governance as a new vehicle for the emerging 'smart city' [7] or IoT-based system for smart city development and urban planning using Big Data analytics [8]. In this research we combine these perspectives through the SmartGov project as a truly inter-and transdisciplinary research project that promotes two-way communication between citizens and urban policy makers to improve the understanding of how socially, economically and environmentally sustainable urban areas can be created using Fuzzy Cognitive Maps (FCMs), open data and social media feeds.

The main contribution of the SmartGov tool is that it makes use of the aforementioned data sources to understand societal demands and identify feasible solutions in the pilot cities. FCMs are an innovative decision support tool which allows for modelling and visualisation of the collaborative discussion involving all stakeholders, creation of real time urban government management and participatory approaches in Smart Cities.

This research focus on the following question: what is the role of digital technologies in promoting smart city governance and what are the outcomes of using ICT in the decision-making processes? The SmartGov project has the objective of strengthen urban governance, decision support and citizens engagement in (smart) cities. For this reason this paper addresses the research question by analysing the potential application of smart technologies to support decision-making and related outcomes. The main expected result of this paper is a generic framework of

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² <http://wegovnow.eu>

inputs and outcomes of the Smart City Governance concept built based on the analysis of the SmartGov project.

The rest of this paper is structured as follow. The section 2 presents the theoretical background in which the topics of emergent technologies in government and Smart cities are addressed. The section 3 presents the case study scenario description. Section 4 discusses some potential results and the proposed framework. The final section presents the conclusions of the paper and future work.

2 THEORETICAL BACKGROUND

The intensive application of digital technologies comes along with the “smart governance” and “smart government” definitions, which emphasize the use of ICTs to promote an environment for collaboration (along with participation and citizen engagement) and information sharing, that in turn increases and enables evidence-based decision making [9, 10, 11, 12]. Bringing this to the smart city context, Castelnovo, Misuraca and Savoldelli [4] defined ICT-enabled city governance as the application of technologies to, among other things, facilitate public service interaction and enable citizens participation in order to guarantee that their needs are taken into account. Thus, smart city governance can be seen as a form of smart governance, by promoting stakeholders collaboration and especially citizen participation to improve the decision-making processes that are data-driven, as well as improving the quality of life in the cities. Meijer and Bolivar [13] states that governing smart cities is related to the use of ICT to shape new forms of human collaboration.

Citizen engagement is one of the main elements of smart city governance [4]. Citizen centricity is a new mechanism for governments to use ICT in order to enhance citizen’s engagement with political discourse and decision making, influencing meaningful change in public policy and governance [14, 15]. In order to create responsive governance, social media applications have a key role when adopted by the public sector. According to Bekkers, Edwards and Kool [16] social media monitoring can facilitate more responsiveness in policymaking, co-production with citizens, but also facilitate governance processes in which citizens participate and public organizations take into account their ideas and suggestions. For instance, social media can support to identify relevant stakeholders and achieve greater collaboration, as well as assessing their opinions by monitoring, analysing, and measuring social media activity [17].

Data-driven decision-making is one of the main elements of smart governance, focusing on the “practice of basing decisions on the analysis of data rather than purely on intuition” [18, p.53]. According to Ruppert et al. [19], data-driven is one of the methods to make knowledge-based decisions, which in the policy-making domain include social media analysis, text analysis, and statistical data analyses approaches. Data can be used to predict the impact of policy interventions, but considering the uncertainty of human behavior, real time evaluation and stakeholder’s engagement should be considered in all stages of policy making to drive towards better policies.

One of the main elements that contribute to data-driven decision-making is open government data (OGD). OGD is related to making public sector information available in open formats that can be used and exploited by the public [20]. Among the benefits of open data such as generating social capital and creating value within the economic context, open data can contribute to the advancement of good governance, increasing the quality of policy making and promoting open governance [21]. In order to achieve open governance is important to transform the relationship between government and the public, as well as relying on information and communication technologies (ICT) to mediate this process [22].

3 CASE STUDY: SMARTGOV

This section first describes the SmartGov project followed by the discussion of the two pilots of the SmartGov project.

3.1 Description of the SmartGov project

The SmartGov project offers advanced decision support for Smart Governance. It is an international and interdisciplinary project shaped by 8 partners from four EU –countries: Austria, Cyprus, Netherlands and Spain with an excellent balance of research partners, service & software engineering companies, as well as governmental partners acting as pilot cities. The project has received funding from the European Union’s Horizon 2020 research and innovation program carried out within the JPI Urban Europe ENCSS call.

The SmartGov project seeks to strengthen contemporary urban governance, decision support and two-way communication between citizens, governments and other stakeholders in (smart) cities. There is a huge, but underdeveloped potential of linked open data and social media as crowdsourcing tools that replace regular data collection for decision-making. SmartGov will innovatively integrate these data sources with Fuzzy Cognitive Maps (FCMs), to enable quantitative modelling of complex problems and simulation of dynamic behavior of factors underlying these problems. Fuzzy cognitive maps are fuzzy-graph structures for representing causal reasoning. Their fuzziness allows hazy degreed of causality between hazy causal objects (concepts) [23, p.65]. FCMs are created in a dedicated FCM modeling and simulation software from experts together with the domain experts.

Hence, decision-makers and citizens can effectively utilize (currently inaccessible) open data, social media feeds and expert-based FCMs to simulate impacts of different scenarios and to improve two-way communication between governments and citizens. Building on systematic evidence reviews, the goals of SmartGov are: 1) to develop a set of user-friendly tools in accordance with legal frameworks, including a FCM-based data-integration tool, a social media engine, advanced visualization and text analysis tools; 2) to test and implement the tools in cities in Cyprus and Spain, in the domains of low-carbon energy, transport systems, and sustainable tourism, and 3) to disseminate the outcomes throughout Europe.

3.2 Description of the pilots

3.2.1 Pilot Limassol

The primary objective of the Municipality in Limassol in Cyprus is to improve the waste collection service and to harmonize the traffic flow in the target area. The targeted geographic area covers the residential area of Limassol. The main benefits are the reduction of traffic hazards and congestions for citizens using their vehicles on the same routes as the waste collection vehicles improving the mobility for citizens, minimizing the energy costs of the waste collection vehicles and decreasing the discharge of air contaminants in the city. For building different scenarios to evaluate the impact of the municipal interventions different data has to be included: data collected via GPS installed in the vehicles that execute the service, geospatial data regarding administration boundaries, residential areas and road networks (open data portals), annual average daily traffic (open data) and internal data for traffic violations and garden services complaints/requests. Data from the official social media of the municipality is also combined with those data sets to provide inputs for the expert-based FCMs to be built. Citizens' participation is stimulated in social media and workshops. Through simulation of different scenarios by running the fuzzy cognitive maps the routes of the waste collection vehicles- both permanent and temporary in case of road works or accidents- can be evaluated.

3.2.2 Pilot Quart de Poblet

The Municipality of Quart de Poblet in Spain is aiming to reduce the traffic and number of cars surrounding the school premises during drop-off and pick-up times in order to create a safer and cleaner environment for pupils. Volunteering chaperones will take and bring small groups of school kids to and from school by foot. The targeted geographic area will cover the areas of the Municipality of Quart De Poblet that are publically accessible to pedestrians. With the optimal assessment of walking routes, the overall safety of pedestrians can be improved, having fewer cars surrounding the schools during peak times when parents pick up their children. The municipality will be able, through simulating scenarios with the fuzzy cognitive map tool, to evaluate how different measures impact the mobility of pupils. Available and in addition to be collected datasets will feed into the fuzzy cognitive map. Internal and open databases are taken into account such as the map of the city, the number of cars, pollution rates, as well as weather forecasts. For the collection of feedback from social media channels specific opinion maps, blogs and discussion will be created on the existing social media channels of the municipality and its council members, and therefore serve as a bridge for communication with the stakeholders.

4 RESULTS AND DISCUSSION

In order to understand the role of digital technologies in promoting smart city governance we have focused on the inputs and outcomes of this process in the use of technologies for

policy making in the context of the SmartGov project. The main result of this study is a framework that is discussed and presented in this section.

Based on the theoretical background, we understand that smart city governance is the use of ICT-based evidences (data or people as sources) to improve decision making and deliver results that meet the needs of the citizens and improve the quality of life in the cities. In the aforementioned use cases it is possible to identify a variety of data as inputs for building different scenarios to evaluate the impact of the municipal interventions.

The main outcomes of the use case analysis and literature review are:

- Considering the main identified dimensions of smart city governance, collaboration and participation are stimulated by connecting experts and policy makers to build the foundation of the FCMs.
- Data-driven decision-making is evidenced by the use of open, internal and social media data to provide the value of the concepts in the domain in which the FCMs are created.
- Openness and transparency are also stimulated in both the agenda setting and interventions that are evidence-based.
- Co-production with citizens occurs during the collection of data with the target group to understand people's needs to make better decisions.

As a result of this collaborative process smart outcomes are expected by simulating the impact of scenarios before making the decision, enhancing citizen centricity, delivering smart city services (defined as "innovative services using ICT in city planning and management" [24, p.94]), and consequently improving the quality of life in the cities.

The Figure 1 illustrates the Smart City Governance based on the case of SmartGov:

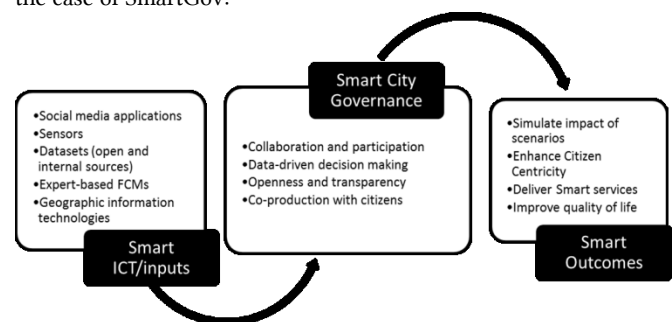


Figure 1: Smart City Governance in the case of SmartGov.

Based on the proposed framework we suggest that smart ICTs, such as social media applications, geoinformation systems, open data portals, among others, serve as platforms to provide inputs for data-driven decision-making and promoting smart city governance.

5 CONCLUSIONS

This paper provides an overview about the role of digital technologies in promoting smart city governance by analysing

the SmartGov project as a use case. Among the main elements of smart city governance is the citizens' engagement and data-driven decision-making supported by ICT-tools. The main result of this paper is the proposed generic framework of inputs and outcomes of Smart City Governance that was built based on the analysis of the SmartGov project. By analyzing the pilots of the SmartGov project we identified potential applications of smart technologies to support decision-making and related outcomes. The discussion and the proposed framework are of interest for a diverse set of stakeholders, from academia, to government and practitioners who can benefit from the study, and support further debate regarding the role of Smart ICTs in interconnecting citizens and government in a smart city. Future work includes analysing the outcomes of the SmartGov project through the proposed framework (taking a smart city governance perspective) with a deeper understanding of the data sources, the decision making process and the involved actors.

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