Anna Visvizi
Orlando Troisi *Editors*

Managing Smart Cities

Sustainability and Resilience Through Effective Management

Springer

Managing Smart Cities

Anna Visvizi · Orlando Troisi
Editors

Managing Smart Cities

Sustainability and Resilience Through Effective Management

Springer

Editors
Anna Visvizi
Institute of International Studies
SGH Warsaw School of Economics
Warsaw, Poland

Effat College of Business
Effat University
Jeddah, Saudi Arabia

Orlando Troisi
Department of Management and Innovation Systems
University of Salerno
Fisciano, Italy

ISBN 978-3-030-93584-9 ISBN 978-3-030-93585-6 (eBook)
https://doi.org/10.1007/978-3-030-93585-6

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

The idea behind the book was born out of our conversations and joint research and the resulting recognition that in the otherwise rich debate on smart cities several topics require a more thorough insight. Another set of considerations that we had derived from the recognition that all too frequently the ideas that researchers and academics have and frame through their publications do not reach the decisionmakers. Clearly, a gap in communication exists between the communities of researchers and decision makers. This book sought to address this issue by making research on smart cities handy and understandable to decision makers. The reference to effective management employed in the title of the book is meant to highlight the centrality of management and managerial skills in the context of boosting collaboration, entrepreneurship, employment, participation, inclusion, and co-creation in the smart city. In other words, while technology is crucial, it is the ability to apply it consciously and efficiently, e.g. through efficient management techniques, that drives the transformation of cities to smart cities in a manner conducive to their sustainability and resilience.

This book would not be possible without the Publisher and the Publishing team, who, once again, proved to be one of the kindest and the most professional on the market. In this context, our personal 'thank you' is extended to Dr. Hisako Niko. We are indebted to her. We would also like to express our gratitude to the reviewers who offered very useful insights into how the book's content could be improved. Finally, we would like to thank the contributing authors for their hard work and patience throughout the lengthy process of editing this volume.

Warsaw, Poland — Anna Visvizi
Fisciano, Italy — Orlando Troisi

Acknowledgments Research reported in this book has been conducted in partial implementation of the National Science Center (NCN), Poland, Grant Number 2020/39/B/HS4/00579, titled: Smart cities: Modelling, Indexing and Querying Smart City Competitiveness.

Contents

Editors and Contributors

About the Editors

Anna Visvizi, Ph.D. (dr hab.) Institute of International Studies (ISM), SGH Warsaw School of Economics, Warsaw, Poland & Effat College of Business, Effat University, Jeddah, Saudi Arabia. Her research interests include issues unfolding at the intersection of politics, economic and ICT, which translates in her research on smart cities and applied aspects of ICT.

Orlando Troisi, Ph.D. Associate Professor, University of Salerno, Fisciano, Italy. His research interests include strategic management including governance and marketing; knowledge and information management.

Contributors

Nehal Alyamani Effat University, Jeddah, Saudi Arabia

María Dolores Andújar-Montoya Department of Building Sciences and Urbanism, University of Alicante, Alicante, Spain

Alessandro Baroncelli Università Cattolica del Sacro Cuore, Milan, Italy

Antonio Botti Department of Business Science, Management & Innovation Systems, University of Salerno, Fisciano, Italy

Delphine Cheng KU Leuven, Leuven, Belgium

Katarzyna Ciupa SGH Warsaw School of Economics, Warsaw, Poland

Esmir Demaj EPOKA University, Tirana, Albania

Mina Fanea-Ivanovici Department of Economics and Economic Policies, The Bucharest University of Economic Studies, Bucharest, Romania

Virgilio Gilart-Iglesias Department of Computer Science Technology and Computation, University of Alicante, Alicante, Spain

Mara Grimaldi Department of Business Science, Management & Innovation Systems, University of Salerno, Fisciano, Italy

Timothy Hagen EPOKA University, Tirana, Albania

Samedi Heng Université de Liège, Liège, Belgium

Xhimi Hysa EPOKA University, Tirana, Albania

Anetta Anna Janowska SGH Warsaw School of Economics, Warsaw, Poland

Mohamad Kashef Effat University, Jeddah, Saudi Arabia

Marek Kozlowski Faculty of Design and Architecture, University Putra Malaysia, Seri Kembangan, Malaysia

Alba Kruja EPOKA University, Tirana, Albania

Francesca Loia Department of Economics, Management and Institutions, University of Naples 'Federico II', Naples, Italy

Gennaro Maione Department of Business Science—Management & Innovation Systems, University of Salerno, Fisciano, Italy

Radosław Malik Institute of International Studies (ISM), SGH Warsaw School of Economics, Warsaw, Poland

Rafael Mollá-Sirvent Department of Computer Science Technology and Computation, University of Alicante, Alicante, Spain

Antonella Monda Department of Business Science, Management & Innovation Systems, University of Salerno, Fisciano, Italy

Higinio Mora Department of Computer Science Technology and Computation, University of Alicante, Alicante, Spain

Stefania Operto University of Genova, Genoa, Italy

Mauro Palumbo University of Genova, Genoa, Italy

Marius-Cristian Pană Department of Economics and Economic Policies, The Bucharest University of Economic Studies, Bucharest, Romania

Stefano Poli University of Genova, Genoa, Italy

Raquel Pérez-delHoyo Department of Building Sciences and Urbanism, University of Alicante, Alicante, Spain

Saeed Mian Qaisar Effat University, Jeddah, Saudi Arabia

Laura-Diana Radu Accounting, Business Information Systems and Statistics Department, Faculty of Economics and Business Administration, Alexandru Ioan Cuza University, Iasi, Romania

Giuseppe Roccasalva Department of Architecture and Design (DAD), Polytechnic of Turin, Turin, Italy

Massimo Ruberti Università Cattolica del Sacro Cuore, Milan, Italy

Orlando Troisi Department of Management & Innovation Systems, University of Salerno, Fisciano, Italy

Konstantinos Tsilionis KU Leuven, Leuven, Belgium

Anna Visvizi Institute of International Studies (ISM), SGH Warsaw School of Economics, Warsaw, Poland;
Effat College of Business, Effat University, Jeddah, Saudi Arabia

Ana Iolanda Voda Social Science and Humanities Research Department, Institute of Interdisciplinary Research, Alexandru Ioan Cuza University, Iasi, Romania

Yves Wautelet KU Leuven, Leuven, Belgium

Yusnani Mohd Yusof Centre for Advanced Research, University Brunei Darussalam, Bandar Seri Begawan, Brunei

Effective Management of the Smart City: An Outline of a Conversation

Anna Visvizi and Orlando Troisi

Abstract Advances in information and communication technology (ICT) are central for the transformation of cities into smart cities. Yet, it is the ability to apply ICT efficiently that defines whether a smart city will be resilient and sustainable. The art of management stands at the heart of the process and this book explores it. In this chapter an outline of the key research topics that emerge at the intersection of smart cities research and management science is presented. These include among others management and decision-making for urban design and the built environment development, the relationship between the smart city services and business growth dynamics, new forms of asset acquisition, and entrepreneurship development. Finally, the research topics include questions of the social accountability of local governments vis-à-vis smart city development; inclusion and participation in the decision-making process in the smart city; and for instance, access to and management of cultural goods and heritage.

1 Introduction

In the rich debate on smart cities, some topics remain under discussed, while some seem to be too distant to make a natural candidate for a new research avenue. Recognizing the caveats and contingencies that these considerations bear, this book explores issues and developments that unfold at the interface of management and smart cities. The chapters included in this book, each in its own way, prove the case that, inasmuch as advances in information and communication technology (ICT) are central to the

A. Visvizi (✉)
Institute of International Studies (ISM), SGH Warsaw School of Economics, Al. Niepodległości 162, 02-554 Warsaw, Poland
e-mail: avisvi@sgh.waw.pl

Effat College of Business, Effat University, Jeddah 21478, Saudi Arabia

O. Troisi
Department of Management & Innovation Systems, University of Salerno, Via Giovanni Paolo II, 132 Fisciano, Italy
e-mail: otroisi@unisa.it

A. Visvizi and O. Troisi (eds.), *Managing Smart Cities*,
https://doi.org/10.1007/978-3-030-93585-6_1

transformation of cities to smart cities, ultimately the success of that transformation is a function of effective and efficient management practices, implemented at diverse levels of the (smart) city. In other words, while technology is crucial, it is the ability to apply it consciously and efficiently that drives the transformation of cities to smart cities in a manner conducive to their sustainability and resilience (Ciasullo et al., 2020; Pérez-del-Hoyo et al., 2021; Visvizi et al., 2017). This book applies a managerial understanding to the smart city and, indeed, smart urban systems' management (Kashef et al., 2021; Troisi et al., 2022). This approach allows the editors to highlight the mechanisms and the processes that boost collaboration, entrepreneurship, employment, participation, inclusion, and co-creation in the smart city (Lytras & Visvizi, 2021; Lytras et al., 2021; Polese et al., 2018; Varela et al., 2021). It is highlighted that ICT and its application in the city space may have a fundamentally positive impact on smart city inhabitants (Lytras & Visvizi, 2018; Visvizi & Lytras, 2019). However, as the following chapters showcase, it is the way in which the smart city and the smart urban system are managed that is decisive in delivering on the promise inherent in ICT-enhanced smart city solutions (Visvizi et al., 2017; Calzada & Almirall, 2020).

This book covers three broad sets of interconnected topics. The first is concerned with management and decision-making for urban design and infrastructure development and includes questions of accessibility; sustainable energy management; urban logistics and mobility; and broader solutions aimed at the urban built environment and infrastructure management. The second group of topics discussed covers the question of management and decision-making in the context of smart cities' development, including the relationship between the smart city services and applications, business growth dynamics, and new forms of asset acquisition, for example through crowdfunding; entrepreneurship development; and research and development (R&D) promotion. Finally, the third group of topics offers insights into ways of promoting and ensuring participation, representation and co-creation in the smart city, including questions of the social accountability of local governments vis-à-vis smart city development; ensuring senior citizens' inclusion and participation in the decision-making process in the smart city; and access to and management of cultural goods and heritage. These three broad groups of topics, and the chapters that provide them in with content, offer an opportunity to acquire a clear, direct and practice-driven knowledge and understanding of the way in which effective management allows ICT-enhanced tools and applications to change the physic of the (smart) city, and therefore, essentially, make it smarter.

2 A Chapter Summary

In recognition of the multidisciplinary nature of the discussion, the book has been divided into three parts. Part 1 deals with issues pertaining to the broadly defined question of the built environment and thus managing infrastructure accessibility and usability in the smart city. Chapters "A Smart City Initiative for Participatory

Urban Accessibility Planning and Management" to "Smart Sport Arenas Make Cities Smarter" explore the intricacies of urban planning and infrastructure development. The latter two are viewed as essential for the development of a sustainable and resilient city space and the gradual adoption of ICT-enhanced smart city services and applications. Part 2 addresses the still nascent question of entrepreneurship and business performance in the smart city context. Indeed, the authors of chapters "Crowdfunding as a Smart Finance and Management Tool: Institutional Determinants and Well-Being Considerations. Evidence from Four Central and Eastern European Countries" to "Smart-Social Business Cities: The Evolution, Concepts, and Determinants" discuss ways of boosting entrepreneurship in the smart city. The notions of crowdfunding strategies for and in smart city projects, as well as social business and social business models are also discussed. Finally, Part 3 explores the question of how to manage participation, representation and co-creation in the smart city. Chapters "Social Accountability of Local Governments in Smart Cities: A Multiple Case Study" to "Circular Practices with a Public Driven Local Development Processes" explore the means and mechanisms relating to involving citizens in issues and processes through which the smart city is constituted and re-constituted over time. Case studies embellish the conversation.

Part 1 opens with the chapter (chapter "A Smart City Initiative for Participatory Urban Accessibility Planning and Management") by Raquel Pérez-del-Hoyo, María Dolores Andújar Montoya, Higinio Mora, Virgilio Gilart-Iglesias, which discusses the multiple challenges that beset accessibility and thus urban mobility. As the authors argue, the prospect of managing and addressing deficiencies in the built environment of the smart city are intertwined with citizens' awareness of the issue, i.e. awareness of the existence of those limits and barriers to mobility, both in connection to citizens' own needs and to those of fellow citizens. Accordingly, the authors query synergies that might emerge at the interface of the use of new technologies and the information provided by citizens themselves in connection to urban design and the built environment. The use of this information would allow identification of and response to real needs, i.e. accessibility, in a dynamic manner. The authors propose how ICT might be deployed for the analysis of the urban user's experience and accessibility to movement, allowing accurate information about urban barriers to be obtained directly from citizens. In this way, ICT not only provides information about accessibility issues, but also allows the monitoring of their effectiveness over time. Several case studies have been carried out in different urban environments to validate the proposed methodology.

In chapter "Towards a Smart City in the Tropics: The Malaysian Approach", Marek Kozlowski and Yusnani Mohd Yusof explore the case of smart city development in Malaysia. As the authors argue, since the 1980s, the major cities in Malaysia have witnessed a spate of urban redevelopment, including institutional, office, and mixed-use complexes, shopping malls, educational establishments, and residential neighborhoods. The current urban makeover in Malaysia is mainly market-driven and is characterized by fast-track development, emphasis on catalyst megaprojects, infrastructure and global connections. Such an approach is often contrary to the basic principles of a smart city concept. This chapter provides a deeper understanding of the

complexity of changing urban landscapes in Malaysia, strongly influenced by globalization and neoliberalism. By selecting three cities: Kuala Lumpur, Kota Kinabalu and Melaka, this study addresses the development patterns in these cities and evaluates how innovative and sustainable policies are applied to solve urban problems and achieve better smart city status. To this end, qualitative research methods such as literature review, qualitative analysis, secondary data collection, field surveys, and observations are employed. This study provides a deep insight analysis and evaluation of urban development in Malaysia and highlights the conflict between economic growth and progress and the principles of sustainable and smart urban environments. The outcomes of this study identify gaps in urban planning and management mechanisms that are essential for Malaysian cities to achieve smart city status.

In chapter "A Review of Charging Schemes and Machine Learning Techniques for Intelligent Management of Electric Vehicles in Smart Grid", Saeed Mian Qaisar and Nehal Alyamani offer a critical review of the charging schemes and machine learning techniques necessary for managing a smart grid, especially in the context of electric vehicles (EVs) and their use in the smart city. The authors argue that the evolution of ICT is a necessary component of the process through which smart cities develop and advance over time. A smart grid is a vital element of any smart city. One of the major imperatives today is the deployment of ecofriendly intelligent systems to improve the quality of life of its habitants while ensuring sustainability. To attain sustainable and green transportation, the deployment of EVs is needed. Integration of EVs has raised various challenges, such as charging infrastructures and load forecasting. Therefore, intelligent management techniques are required. Various appealing tactics have been presented to solve such challenges. These are mainly based on the Internet of Things (IoT), machine learning algorithms and automata models. This chapter presents a comprehensive review of EVs charging schemes, standards, and the application of various machine learning algorithms to intelligently manage EVs in smart grid-based future cities.

In chapter "Managing Safety and Security in the Smart City: Covid-19, Emergencies and Smart Surveillance", Orlando Troisi, Mohamad Kashef, and Anna Visvizi focus on the role of and the potential inherent in surveillance systems in smart cities today. The Covid-19 pandemic and the resultant restrictions to mobility on the one hand and the need for strengthened enforcement measures highlighted the already existing weaknesses and contingencies besetting surveillance in smart cities. The chapter makes a case that the adoption of smart city surveillance and infrastructure management systems may contribute to the improvement of safety and security in the smart city as well as to an overall enhancement of the smart city's resilience. The discussion in this chapter focuses on the complex processes of data acquisition, data sharing, and data utilization to explain ways in which they all add to smart surveillance systems that—while wary of individual freedoms and privacy issues—contribute to the process of making a smart city resilient. In showcasing the applicability of these findings, a wireless mesh network (WMN) surveillance system is presented.

Chapter "Smart Sport Arenas Make Cities Smarter", by Alessandro Baroncelli and Massimo Ruberti, addresses the notion of an athletics' infrastructure in smart

cities. As the authors argue, several challenges beset the proper design and efficient operation of an athletics' infrastructure, and enabling this to work and thrive is very much an issue of management and managerial practices. ICT and the potential inherent in it offer a handle to facilitate the process. As the authors argue, cities are home to more than half the world's population, and the pace of urbanization accelerates. Cities face increasing environmental pressures and infrastructure needs. These are coupled with growing residents' demands not only for a better quality of life, but also at a sustainable cost. Smart technologies and smart management practices offer a way of navigating these challenges. To substantiate this point, this chapter deals with sports arenas, and, in particular, with stadiums. It presents the most advanced worldwide practices to show how sports arenas can improve sport clubs' economic performance and fans' satisfaction and how they might strongly contribute to the creation of smarter cities. Rebranding stadiums, modernising them to better calibrate their capacity, refurbishing old venues and new stadium projects involve high-level investments, and they require an organisational transformation both for sports clubs and cities. Municipalities and sport clubs can, therefore, be partners in developing technologically advanced and resilient sports arenas and related infrastructures that will be well integrated into the urban design, both inside and outside the areas where they are built, supporting rather than putting a strain on cities in many ways. A modern stadium must be safe, smart, green, accessible, efficient and innovative: digital solutions allow a user-friendly urban environment that enhances citizens' well-being, welcoming them into a space where emotions and needs can meet.

Chapter "Crowdfunding as a Smart Finance and Management Tool: Institutional Determinants and Well-Being Considerations. Evidence from Four Central and Eastern European Countries" opens the second part of the book. Here, Mina Fanea-Ivanovici and Marius-Cristian Pană explore the mechanism of crowdfunding and the possibility of employing it in a smart city and smart city development projects. Crowdfunding promises to improve access to finance for larger numbers of citizens and businesses, by bringing together the demand and supply of available funds on a digital platform outside the well-established regulated banking system. Crowdfunding depends on technology-related factors, and on a regulatory framework in terms of traditional financial activity and crowdfunding legislation progress. Country-specific credit and financing conditions on the regulated financial market may explain the search for alternative financing methods. These factors are analyzed for four Central and Eastern European (CEE) countries, Bulgaria, Hungary, Poland and Romania. We also analyze the influence of increased well-being on crowdfunding development in the selected countries in order to explain that the former is a determinant of crowdfunding development even in the absence of specific crowdfunding regulations. Crowdfunding covers financing needs for personal and business projects, and for civic projects in the context of smart city development. It is, therefore, an instrument to be considered by city managers.

Chapter "The Role of Smart Cities in Stimulating and Developing Entrepreneurship", by Laura-Diana Radu and Anna Iolanda Voda, queries the interface of entrepreneurship in the smart city context. As the authors argue, the relationship

between the smart city and entrepreneurship is bidirectional. A smart city offers new opportunities for entrepreneurship to achieve sustainable development of urban communities. These bring new challenges for entrepreneurs that must operate in ultra-connected and intelligent environments, characterized by continuous innovation. They have some significant benefits in smart cities, for example the availability and quality of information and communication technologies that offer access to data and services and allow us to discover new knowledge and to implement new business ideas. The real-time connection between entrepreneurs and between entrepreneurs and government is another advantage for entrepreneurs that facilitates the exchange of information and access to recent business ideas and innovation. The availability of highly skilled human resources is another benefit. Entrepreneurs have access to smart, creative, and involved employees, which increases the chance of the economic success of any viable business. The interest in social and environmental sustainability is considered to be another advantage that offers opportunities for entrepreneurs to invest in new green industries to reduce pollution and to support sustainable development. This chapter aims to address more broadly, continuative and contrasting insights into entrepreneurial processes and new business opportunities in smart cities. Our focus will be on the role that cities can play in stimulating and developing entrepreneurship, and on the way in which smart cities' challenges could be transformed into opportunities for entrepreneurs.

In chapter "Smart-Social Business Cities: The Evolution, Concepts, and Determinants", Xhimi Hysa, Alba Kruja, Timothy Hagen, and Esmir Demaj explore the notion of social business and the prospect of its development in the context of the smart city. It is argued that recent research shows the significant role that entrepreneurship has in advancing smart cities. Nonetheless, a big concern is making cities smart and sustainable. Technological aspects must be intertwined with the human aspects. Since 2006, when Muhammad Yunus received the Nobel Peace Prize, the popularity of the concept of social business increased in the marketplace and in academia. In the practical context, nowadays many smart cities are, at the same time, social business cities. An example is the city of Barcelona. Still, academic research lacks attention in combining the factors that characterize a city as both smart and social business oriented. Using a systematic literature review, current research aims to explore worldwide cities that are simultaneously smart and social business cities, identifying common determinants and synthesizing a conceptual framework for Smart-Social Business Cities. This study concludes with implications and recommendations for governing bodies, academics, and other relevant stakeholders that are part of a city ecosystem.

In chapter "Social Accountability of Local Governments in Smart Cities: A Multiple Case Study", Francesca Loia and Gennaro Maione explore social accountability (SA) in the smart city. As the authors argue, over the years, the international standards for promoting SA-oriented behaviors have undergone several changes to ensure adaptation to the demands of contemporary society. This trend, emerging at the level of operating practice, is confirmed by the growing interest in SA expressed by public accounting and management scholars. However, the analysis of the literature highlights the poor attention paid to the study of the SA of local governments

(LGs) involved in smart city projects, although the latter are revolutionizing the way of life of citizens in many countries all over the world. Based on these considerations, the objective of this chapter is to examine how ICT-enhanced services and applications for smart cities enable LGs to be more socially accountable, and how ICT-enhanced services and applications for smart cities allow the LGs to track the accountability of the stakeholders involved in the administration/management of smart cities. The findings of this chapter are based on interviews conducted across Italian municipalities involved in smart city projects.

The focus of chapter "How to Improve Social Participation of Senior Citizens Thorough ICTs: A Techno-Demographic Challenge for an Effective Smart City", by Mauro Palumbo, Stefano Poli, and Stefania Operto is directed at the question of participation in the smart city context, especially with regards to these groups of citizens who, due to their impairment, require assistance to participate. Focusing on the challenges that elderly citizens face in the smart city, this chapter dwells on ways in which ICT-enhanced solutions may facilitate elderly citizens' participation. The authors argue that applying technology to the lives of elderly city inhabitants has become an issue for contemporary smart cities and the actors involved in their management. Recommendations conclude the discussion in this chapter.

In chapter "Stakeholder-Based Management of Smart Cities: The Case of Brussels", Samedi Heng, Delphine Cheng, Konstantinos Tsilionis and Yves Wautelet, argue that, while the general tendency is for cities around the world to apply ICT-enhanced solutions and thus transform toward becoming smart cities, many of the constitutive initiatives are implemented in a disconnect from other initiatives and projects implemented in the same city. That is, digital advancement projects have often been conceived in silos with the focus being only on one or a few particular stakeholder(s) with no global coordination. To be successful, smart cities need to evaluate consistently the projects in their portfolio and assess their impact on different stakeholders. This chapter identifies the stakeholders playing a central role in the city of Brussels and represents their intentions using the goal-oriented models of the i* framework while surveying the adequacy of each of the stakeholders' goals on the achievement of the strategic objectives of a smart city development. The analysis suggests that sustainable mobility, citizen participation and collective governance are the three main strategic objectives.

Chapter "Culture Powered by Blockchain in Smart Cities", by Radoslaw Malik, Katarzyna Ciupa and Anna Anetta Janowska, examines the question of access to cultural goods in the smart city. In this context, the spotlight is shed at blockchain. As the authors argue, access to cultural goods powered by blockchain is a highly valued and attractive proposition in the context of the debate on smart cities' growth and development. It provides various benefits for at least three groups of stakeholders: artists/creators, consumers, and city authorities. Blockchain facilitates access to cultural goods in smart cities with: (i) improved copyright control; (ii) reduced transaction costs; (iii) provision of reliable information, and (iv) new possibilities for funding of cultural goods by the public. Access to cultural goods powered by blockchain influences smart city growth with: (i) creative businesses development; (ii) a positive impact on other industries, e.g. tourism and ICT; (iii) a creative

buzz attracting creative workers and investors; (iv) higher public and private culture expenditure, (v) improved global accessibility of locally created cultural goods, and (vi) augmented participation in culture. Thus, access to cultural goods powered by blockchain in a smart city is beneficial to city inhabitants' well-being and city livability.

Chapter "The Evolution of the Smart City in Italy: An Empirical Investigation on the Importance of Smart Services", by Antonio Botti and Antonella Monda, aims to bring to light the most used and requested smart city services, to suggest to public managers the areas on which they should work to foster the development of the smart city. Starting from an overview of the smart city concept, the chapter offers an in-depth analysis of smart services in the Italian context. Based on an empirical investigation, the study aims to analyze the most popular services used by citizens and the areas in which policy makers should intervene in order to raise Italian smart cities. By analyzing the results, they provide interesting suggestions that can improve Italian services management.

Chapter "Managing Emergencies Through Resilience: The Case of Turin Smart City", by Mara Grimaldi, explores the enabling factors of resilience as a key lever with which to address complexity, challenge technological evolution and foster growth in urban contexts. The goal of this chapter is to explore the determinants of resilience to understand how smart cities can seize opportunities for innovation, starting from disruptive events, through the right combination of technology, and human and social capital. Resilient smart cities can challenge environmental changes and develop proactive behaviors that encourage the attainment of social, economic and environmental well-being. Therefore, being resilient entails the redefinition of orientation, business models, technology and resource allocation to turn a crisis (such as the Covid-19 pandemic) into an opportunity for development. Given the need to clarify the key determinants of resilience in contemporary cities, this chapter aims to explore: (i) the main drivers for resilience to challenge a crisis; (ii) how the drivers of resilience can be activated and combined to create opportunities for innovation. The empirical research is based on a content analysis that explores the case study of the Italian smart city of Turin. The results allow the identification of the determinants of resilience according to an exploratory approach, in which the smart projects and the set of technologies, resources and institutions exchanged and co-developed by the Turin smart city are classified to obtain some dimensions that enable resilience.

The focus of chapter "Circular Practices with a Public Driven Local Development Processes", written by Corrado Carbonaro and Giuseppe Roccasalva, is directed at the circular economy (CE) as a managerial challenge in the process of designing and developing smart cities. As the authors argue, CE is widely discussed in the academic literature. CE is a practice-oriented development idea that is inductively learning from its practices. With some critical interpretations based on the inventory of practices, this chapter sheds lights on the main features of CE and its value for the development processes. Limitations, types of strategies, alternative impacts, the role of stakeholders and scales of implementation must be taken into account once circular solutions are planned to be designed and introduced in a territory. It is argued

that the most effective CE developments are driven by practices and led mainly by public authorities.

In Chapter 17, by way of conclusion, Anna Visvizi, Orlando Troisi and Miltiadis D. Lytras review, contextualize and discuss the key points raised throughout the book. Against this backdrop, suggestions for future research as well as policymaking recommendations are made.

3 Concluding Remarks

This book arose from the recognition that, albeit incrementally, smart cities have turned into a shared experience of research communities from across diverse disciplines (Visvizi & Lytras, 2018). The original, even if broad, disciplinary boundaries of the smart city debate, did not yield sufficient space for multidisciplinary conversation. Managerial insights and the possibility of employing them in the exploration of the smart city represent a good case in point. Accordingly, the objective of this book is to highlight that managerial science has a lot to offer to the debate on smart cities. Due to the variety of topics addressed, as well as the number of cases discussed, this book will appeal both to academics and practitioners. Among those who would find the book interesting and useful are urbanists, urban geographers, urban planners, economists, municipal officials, those in the ICT industrial sector, futurists, political scientists, sociologists, business scholars and perhaps business reporters.

Acknowledgements Research reported in this chapter and in this book have been conducted in partial implementation of the National Science Center (NCN), Poland, Grant Number 2020/39/B/HS4/00579, titled: Smart cities: Modelling, Indexing and Querying Smart City Competitiveness.

References

Calzada, I., & Almirall, E. (2020). Data ecosystems for protecting European citizens' digital rights. *Transforming Government: People, Process and Policy, 14*(2), 133–147. https://doi.org/10.1108/TG-03-2020-0047.

Ciasullo, M. V., Troisi, O., Grimaldi, M., & Leone, D. (2020). Multi-level governance for sustainable innovation in smart communities: An ecosystems approach. *The International Entrepreneurship and Management Journal, 16*, 1167–1195. https://doi.org/10.1007/s11365-020-00641-6.

Kashef, M., Visvizi, A., Troisi, O. (2021). Smart city as a smart service system: Human-computer interaction and smart city surveillance systems. *Computers in Human Behavior, 124*, 106923. https://doi.org/10.1016/j.chb.2021.106923.

Lytras, M. D., Visvizi, A. (2018). Who uses smart city services and what to make of It: toward interdisciplinary smart cities research. *Sustainability 2018*, 10. https://doi.org/10.3390/su10061998.

Lytras, M. D., & Visvizi, A. (2021). Information management as a dual-purpose process in the smart city: Collecting, managing and utilizing information. *International Journal of Information Management*. https://doi.org/10.1016/j.ijinfomgt.2020.102224.

Lytras, M. D., Visvizi, A., Chopdar, P. K., Sarirete, A., & Alhalabi, W. (2021). 'Information management in smart cities: Turning end users' views into multi-item scale development, validation, and policy-making recommendations'. *International Journal of Information Management, Book, 56*, 102146. https://doi.org/10.1016/j.ijinfomgt.2020.102146.

Pérez-del-Hoyo, R., Visvizi, A., & Mora, H. (2021). Inclusiveness, safety, resilience & sustainability in the smart city context. In A. Visvizi & R. Perez del Hoyo (Eds.), *Smart cities and the UN SDGs.* Elsevier. 9780323851510. https://www.elsevier.com/books/smart-cities-and-the-un-sdgs/visvizi/978-0-323-85151-0.

Polese, F., Botti, A., Grimaldi, M., Monda, A., & Vesci, M. (2018). Social innovation in smart tourism ecosystems: How technology and institutions shape sustainable value co-creation. *Sustainability, 10*, 140. https://doi.org/10.3390/su10010140.

Troisi, O., Fenza, G., Grimaldi, M., & Loia, F. (2022). Covid-19 sentiments in smart cities: The role of technology anxiety before and during the pandemic. *Computers in Human Behavior, Book, 126*, 106986. https://doi.org/10.1016/j.chb.2021.106986.

Varela, E., Mora, H., Visvizi, A., & Mollá-Sirvent, R. (2021). Smart society model for social inclusion based on cryptocurrency technologies. In A. Visvizi, M. D. Lytras, & N. R. Aljohani (Eds.), *Research and innovation forum 2020: Disruptive technologies in times of change. Springer Proceedings in Complexity*. Springer. SBN: 978-3-030-62066-0. https://doi.org/10.1007/978-3-030-62066-0. I.

Visvizi, A., Lytras, M. (2018). Rescaling and refocusing smart cities research: from mega cities to smart villages. *Journal of Science and Technology Policy Management (JSTPM)*. https://doi.org/10.1108/JSTPM-02-2018-0020.

Visvizi, A., & Lytras, M. D. (2019). Smart cities research and debate: What is in there? In A. Visvizi & M. D. Lytras (Eds.), *Smart cities: Issues and challenges: Mapping political, social and economic risks and threats.* Elsevier. ISBN: 9780128166390. https://www.elsevier.com/books/smart-cities-issues-and-challenges/lytras/978-0-12-816639-0.

Visvizi, A., Mazzucelli, C. G., & Lytras, M. (2017). Irregular migratory flows: Towards an ICTs' enabled integrated framework for resilient urban systems. *Journal of Science and Technology Policy Management, 8*(2), 227–242. https://doi.org/10.1108/JSTPM-05-2017-0020.

Anna Visvizi, Ph.D. (dr hab.), Institute of International Studies (ISM), SGH Warsaw School of Economics, Warsaw, Poland & Effat College of Business, Effat University, Jeddah, Saudi Arabia. Her research interests include issues unfolding at the intersection of politics, economics and ICT, which translates in her research on smart cities and applied aspects of ICT.

Orlando Troisi, Ph.D., Associate Professor, University of Salerno, Fisciano, Italy. His research interests include strategic management including governance and marketing; knowledge and information management.

Managing Infrastructure Accessibility and Usability in the Smart City

A Smart City Initiative for Participatory Urban Accessibility Planning and Management

Raquel Pérez-delHoyo, María Dolores Andújar-Montoya, Higinio Mora, Virgilio Gilart-Iglesias, and Rafael Mollá-Sirvent

Abstract Social awareness towards maintaining urban accessibility is a growing concern in modern societies. This consciousness opens up necessary research fields in regard to the possibilities of new technologies to provide innovative methods for monitoring and preserving the accessibility of urban areas. Because of that, the present research focuses on the synergy of the use of new technologies and the information provided by citizen themselves that allows to meet the real needs of people with movement disabilities in a dynamic manner. The methodology proposed in this work allows the deployment of information and communication technology for the analysis of the urban user's experience and accessibility to movement, allowing accurate information on urban barriers to be obtained directly from citizens. In addition, it not only provides information on accessibility issues, but also allows the monitoring of their effectiveness over time. In this respect several case studies have been carried out in different urban environments to validate the proposed methodology. First, the system was tested in the environment of the University of Alicante in Spain, detecting existing accessibility issues in different scenarios of the University Campus. The evaluation was focused on the analysis of students and lecturers' daily paths across the campus (outdoors) and their movements inside of the buildings (indoors). Afterwards, the sample was expanded to the identification of the degree of inclusion in one of the city's neighbourhoods. As a result, the authors determined that Technology

R. Pérez-delHoyo (✉) · M. D. Andújar-Montoya
Department of Building Sciences and Urbanism, University of Alicante, Alicante, Spain
e-mail: perezdelhoyo@ua.es

M. D. Andújar-Montoya
e-mail: lola.andujar@ua.es

H. Mora · V. Gilart-Iglesias · R. Mollá-Sirvent
Department of Computer Science Technology and Computation, University of Alicante, Alicante, Spain
e-mail: hmora@ua.es

V. Gilart-Iglesias
e-mail: vgilart@ua.es

R. Mollá-Sirvent
e-mail: rafael.molla@ua.es

A. Visvizi and O. Troisi (eds.), *Managing Smart Cities*,
https://doi.org/10.1007/978-3-030-93585-6_2

today is a great ally to promote citizen participation actions, becoming an effective channel for communication between citizens and Administration, and involving the citizens as the core of all the processes concerning the city from planning and design to management and maintenance.

Keywords Inclusive city · Citizen participation · Sensing technologies · Smart city · Social inclusion · Technology-aided urban design · Urban accessibility

1 Introduction: Citizen's Knowledge as a Support to ICT in the Smart City

The adoption of Information and Communication Technologies (ICT) in the daily life of today's society is already a reality. This fact opens new possibilities for collaboration between citizens, public services and the administrations that manage them. In this sense, citizen participation is especially relevant in the field of the Smart city where the convergence of administrations-citizens-and city brings reciprocity, and therefore meaning and humanization, to the Smart city concept. This fact is becoming increasingly important in political agendas and public services, through the promotion of initiatives within the Smart City framework (European Commission, n.d.; Neirotti et al., 2014). The increasing complexity of the management of cities and their public services as a consequence of population growth, makes it necessary to develop these initiatives to face the challenge in an efficient way (Chourabi et al., 2012; Lytras & Visvizi, 2020; Lytras et al., 2020; Rathore et al., 2017; Rudnick, 1980). The challenges arising from demographic changes bring new difficulties such as urban gentrification or social exclusion, as well as new challenges in terms of resource sustainability, health services, or urban security (Glasmeier & Christopherson, 2015). One of the most important aspects that a city can offer to avoid social exclusion, and which directly influences the quality of life of its citizens, is the capacity of that city to be inclusive (Colantonio & Dixon, 2011). The participation of citizens in urban planning implies the democratization of planning, which acts as a mechanism against exclusion (Pearce, 2010). In light of that situation, the contribution of technology through ICT and citizen participation facilitate the design of both public accessibility and sustainable resource management policies (Lytras & Visvizi, 2020; Uribe-Pérez et al., 2016; Visvizi et al., 2017; Yigitcanlar & Han, 2010). The contribution of knowledge is taking a stance as a fundamental pillar that reinforces the potential of ICT in the Smart city as citizen-centred services, turning them into participatory systems where citizens can interact and collaborate with authorities (Del Hoyo & Lees, 2018). An essential aspect where feedback can be produced from administrations-the citizen-and the Smart city is in terms of urban accessibility, understanding accessibility as a universal and elemental factor in the quality of life of citizens (United Nations, 2006).

The premise behind this chapter is to explore how the synergy of citizen participation and ICT can improve people's quality of life, facilitating greater flexibility and

greater inclusion in both urban planning and its maintenance. This will ensure that the whole process meets both the real needs of the citizen and the initial expectations of the administration in a dynamic and prolonged way, avoiding isolated and static actions.

Therefore, the present work focuses on the real, updated and reliable information on the city related to urban barriers that users can provide to public administrations, for its management and monitoring over time, through the development and implementation of the UA Accessibility App. Regarding this reciprocal relationship between 'citizens-public administrations-cities' based on ICT, this chapter develops the following sections. The following section describes the model developed to enable the connection between society—Smart cities—and city governance as interdependent elements. Subsequently, various case studies developed in different scenarios in the city are presented and finally, in the last section, the conclusions are presented.

2 Accessibility Evaluation Model of Smart Cities Integrating 'Citizens-Public Administrations-Cities'

Citizen participation in urban planning and city management allows meeting the real needs of people with disabilities continuously over time, avoiding isolated and non-operational improvement actions. As a consequence, our contribution is focused on pedestrian mobility through the study and analysis of urban accessibility within the Smart city scope. The contribution integrates the capture of urban accessibility diagnoses and the ICT framework to strengthen the transversal nature of urban accessibility from different perspectives. To this end, the design of an ICT-based model has been developed to evaluate the effectiveness of urban accessibility through citizen participation (Mora et al., 2017; Pérez-Delhoyo et al., 2017; Pérez-delHoyo et al., 2018). This evaluation is carried out through the capture of diagnoses that generate accurate, real and updated knowledge about the level of accessibility of the existing public space. The integration of technology and citizen contribution will facilitate the implementation of improvement actions in the maintenance management of cities over time. In addition, it will also facilitate the planning and design of cities that usually do not consider the needs of people with mobility difficulties and other physical or sensory limitations (European Commission, 2010). The contribution of citizen knowledge as active user brings veracity and pragmatism to urban planning and city design. The relationship between the three interdependent variables 'citizens-public administrations-cities' allows identifying needs, habits and preferences that improve the quality of life of citizens. This veracity lies in the positioning of citizens as the main source of information on the real conditions of the city they live in. Therefore, it is necessary to provide a communication channel that allows the flow of information between citizens and public administrations (Fig. 1), generating accurate, real-time knowledge about citizens' experience in the city (Dameri, 2017), to continuously move towards all-inclusive cities.

Fig. 1 Methodology proposed for obtaining information about accessibility problems and improving accessibility of cities. *Source* The authors applying Creative Commons License

This direct communication facilitates the decision making process of the administrations, as well as enabling interaction with the citizen beyond the periods of public exhibition of the urban development projects established by the law (Alfaro Navarro et al., 2017). Additionally, the introduction of citizens in the maintenance phase as active agents in the process, allows overcoming the current barrier of the degradation of cities. This occurs through the identification of accessibility deficiencies or simply loss of effectiveness due to deterioration or breaks or as a result of subsequent actions, such as the later placement of urban furniture that may produce a loss of accessibility on a route that was initially accessible.

Currently, there are no mechanisms that allow a continuous analysis over time to identify whether maintenance is guaranteed in terms of accessibility of the public existing environment or if, on the contrary, there is a degradation or loss of effectiveness of previously planned and designed accessible routes. The mechanisms widely used to obtain this information are focused on specific evaluation actions in specific environments. As a consequence, our research is focused on the automatic and continuous collection of information in any area without geographical limitations. The main objective of our research has been the design of a model to evaluate the effectiveness of urban accessibility in public space of the city, and the public buildings it contains. This assessment is done through automatic monitoring tools supported by technology to discover, evaluate, and dynamically classify urban accessibility issues. The methodology proposed by the authors allows obtaining real knowledge about the state of cities in terms of accessibility directly from citizens, based on their own experience, through an active process of global participation that

materializes the transition towards a truly inclusive and accessible city. The model includes the joint application of technologies that effectively integrate the advantages of ubiquitous sensor-based computing, the characteristics of wireless communication technologies and the cloud computing paradigm in Smart City environments.

The computational model architecture consists of three main layers, the first Layer is the Citizen Location Acquisition Infrastructure, the second refers to Cloud Support Infrastructure and the last layer includes Information Services of urban accessibility. These three layers of the system contain the components of the infrastructure and provide the services as it is developed in Mora et al. (2016). The Citizen Location Acquisition Infrastructure layer allows obtaining and processing citizen locations both in the public space of the city (outside) and inside public buildings through position systems. The Citizens' Location Acquisition Infrastructure layer allows obtaining and processing the positions of citizens both in the public space of the city (outside) and inside public buildings through Radio Frequency Identification (hereinafter RFID) communication technology and Global Positioning System (hereinafter GPS). Furthermore, it makes it possible to generate the flow of movements and the patterns or experiences of such displacements by allowing the distinction between users with reduced mobility and users without reduced mobility. Subsequently, the cloud support infrastructure layer allows the collection and centralisation of locations from GPS devices and/or the smart sensor network and citizen-generated accessibility incidents. In addition, this infrastructure allows the creation of Key Accessibility Indicators (hereinafter KAI), classifying different types of urban accessibility problems as shown below. This layer developed by the authors in Mora et al. (2017) ensures system scalability and availability, reliable data delivery and interoperability with different types of sensors and technologies. It also includes a Structuring Information Component that calculates the possible routes followed by citizens. Finally, a component for urban accessibility problem detection is included through an automatic method, using the acquisition system defined in the previous paragraph, together with a second method of citizen collaboration through a smartphone application—UA Accessibility App—and internet of things (hereinafter IoT) solutions. The automatic method makes it possible to compare and analyse the differences between routes followed by citizens with reduced mobility and routes followed by citizens without reduced mobility, helping along to identify the causes that generate accessibility problems on that route. The automatic method enables the comparison and analysis of differences between the routes followed by citizens with reduced mobility and the routes of citizens without reduced mobility, allowing the identification of the causes that generate accessibility problems on said route.

The installation of the UA Accessibility App in citizens' mobile devices allows obtaining the accessibility experience of the end user, while moving around the urban environment anywhere and anytime. The UA Accessibility App offers the possibility of logging in by entering personal data such as email, date of birth, gender and type of disability, but also choosing the option of logging in without registering (Fig. 2).

Once inside, it opens up the possibility of anonymously uploading photos and comments on incidents regarding accessibility, reporting the claim along with the real location as shown in the image below. Figure 2 also shows a claim detected by a citizen

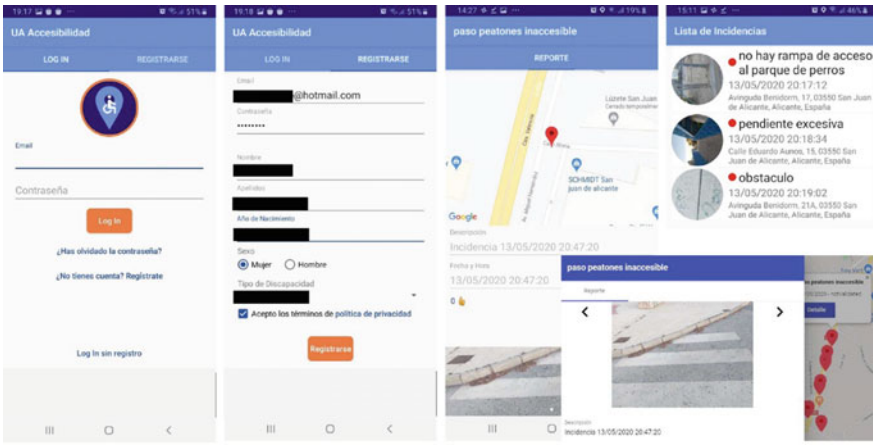

Fig. 2 UA Accessibility App for citizens' mobile devices. *Source* The authors

in which a pedestrian crossing ends at a curb without a ramp, thus preventing to go on that route. All the information collected provides real and updated information on accessibility to public administrations, allowing to know if accessibility is maintained over time or if, on the contrary, it is impeded by daily actions such as construction sites that invade sidewalks with provisional fences, stockage areas or construction sheds, or even due to definitive actions such as the placement of street furniture.

Information transfer is carried out through the last layer of the model, urban accessibility information services, that provide accessibility services to all the agents involved, i.e. citizens and administrations and public companies developed in (Mora et al., 2017). In addition, as specified in previous paragraphs, this infrastructure allows the generation of KAI according to the type of accessibility problems detected, ordering and classifying different types of urban accessibility claims according to the classification of accessible points; inefficient accessibility points; automatic inaccessible points; self-reported points; self-reported inaccessible points; y self-reported inefficient points (Fig. 3).

Accessible points are those locations where accessibility policies have already been applied. These points are graphed in white bordered in blue. Inefficient accessibility points are those urban locations where applied accessibility policies are not working properly, these points are graphed in orange. Automatic inaccessible points are those urban locations not suitable for people with mobility problems, these points are graphed in red. Self-reported points are those locations reported by users, these claims are graphed in yellow. Self-reported inaccessible points are those urban locations not suitable for people with mobility problems reported by users, these points are graphed in white bordered in orange. Self-reported inefficient points are those urban locations where accessibility policies have already been applied but are not working properly and are detected by citizens. These points are graphed in white, bordered in red.

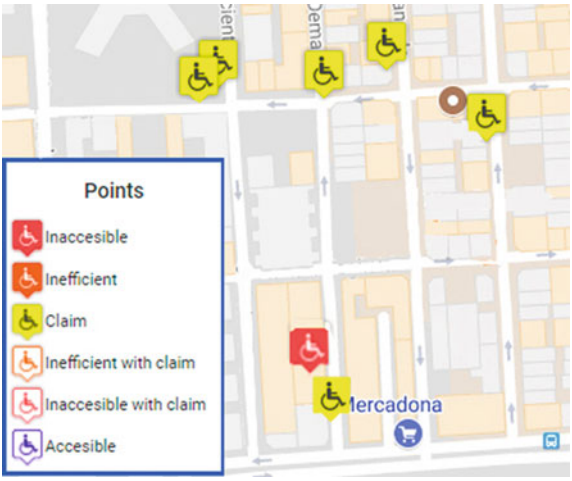

Fig. 3 Sample of KAI obtained. *Source* The authors

3 Sampling, Data Collection and Analysis of Case Studies Developed

After the development of the method, several validations have been carried out through different case studies that allow us to show a real diagnosis of urban accessibility including both the city itself and the public buildings integrated in the city. The research team started from a small stage limited to the campus of the University of Alicante (Alicante, Spain). The campus has a large area of 505,324 m^2 where three different case studies were carried out. Subsequently, the experiment was extended by extrapolating the study to the city of Alicante, specifically to the Benalúa neighbourhood.

All the areas where the four study cases were carried out are highlighted below (Fig. 4). On the left hand side are shown the case studies developed in the University of Alicante campus while on the right hand side it is highlighted the area where the case study 4 in Benalúa neighbourhood was carried out.

All the experiences developed in the campus of the University of Alicante (case studies 1, 2 and 3) allowed us to involve different groups of people with and without disabilities, from different groups that make use of the university in different ways. These collectives included administrative staff, teachers, and students. This diversity enriches the sample by bringing different perspectives to the research since behaviour patterns commonly diverge between university staff and students. It has provided different information not only about some buildings of the campus but also about their most common connections with other buildings and services that are part of the daily life of all participating groups, such as leisure areas, libraries and study rooms, sports areas, vehicle parking areas and public transport services.

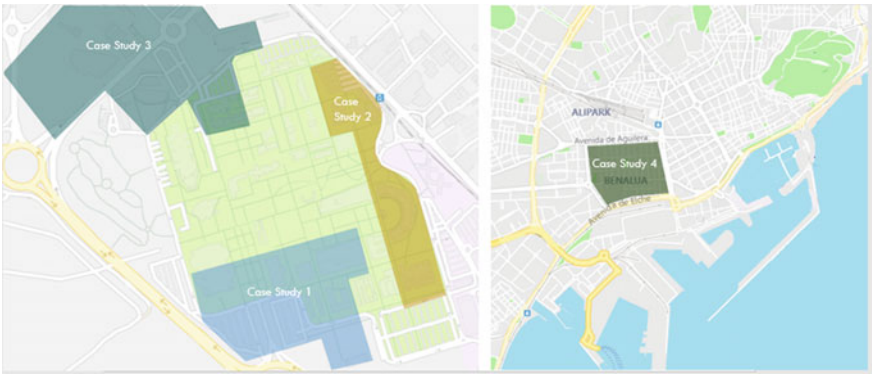

Fig. 4 Areas where the different case studies were carried out. *Source* The authors

4 Results and Discussion

The case studies development has allowed to map the points that prevent a complete social inclusion of students, teaching and research staff and administration and services staff of the University of Alicante. This information enables studying the relationship of people's movement patterns according to their degree of disability, determining, for example, if people with reduced mobility follow the same routes as people without disabilities, or if on the contrary they follow different routes when encountering obstacles such as stairs, ramps with excessive slopes, or any other obstacle that forces them to follow another route. All monitored routes on campus are shown below in Fig. 5.

The first experimentation (case study 1) (Pérez-Delhoyo et al., 2017) was carried out in the southwest area of the campus, and was carried out in both indoors and outdoors contexts. Specifically, the building identified as 0036 in the geographic information system of the University of Alicante (Figs. 5 and 6) was analysed. The Building 0036 is destined to classrooms and offices for campus management services, so it is usually used by all the diverse groups included in the study cases. The study was also extended to the immediate surroundings of the building, analysing the route from building 0036 to the UA Museum (hereinafter MUA) with code 0040, since it represents a relevant cultural area integrated into university social life. In addition, the route from Building 0040 to the leisure areas frequently enjoyed by both students, teachers and other university workers was analysed. These leisure areas identified as Building 0035 include restaurants, stationery store, bookshop, food store, post office and bank services. Finally, the analysis of the route to the nearest parking area was included. The last analysis of case study 1 started from the parking area following the user's route to the general library Building 0033. Both the interior scenes of Building 0036 and the exterior routes shown in the previous figure were validated through the UA Accessibility App, which allowed participants to report incidents and locate this claims via GPS using smartphones. The experience

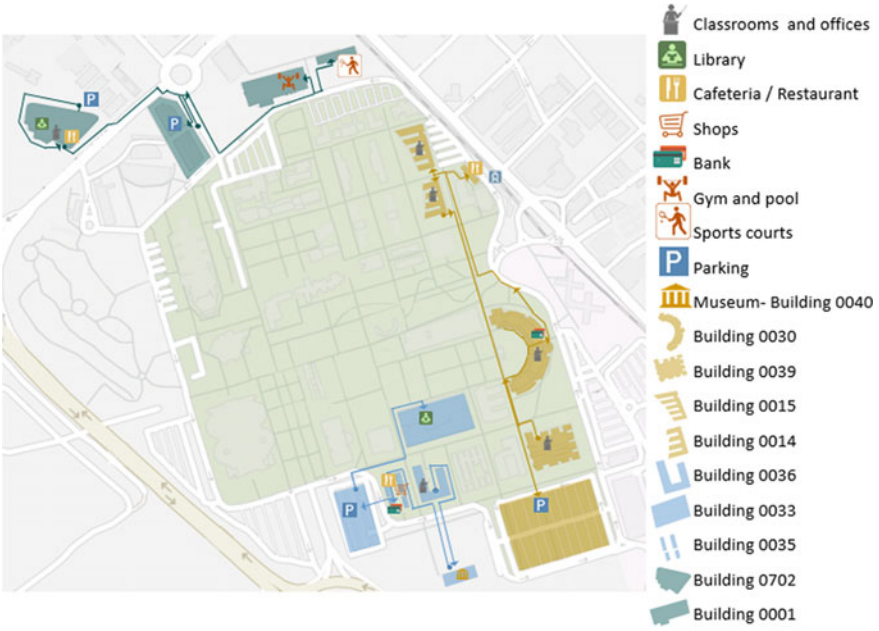

Fig. 5 Routes followed in the case studies developed in the University of Alicante campus. *Source* The authors

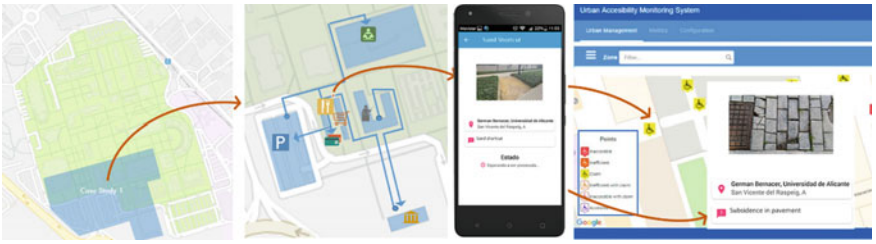

Fig. 6 Sample of case study 1. *Source* The authors

identified claims inside Building 0036 related to lack of maintenance; barriers due to the placement of furniture; irregular flooring uncomfortable for wheelchair users; excess weight on several access doors that also have a manual opening systems; inaccessible information point due to the height of the counter or the absence of an adapted toilet on the ground floor. Experimentation from building 0036 to other relevant areas in university social life also showed other claims reported by the participants. These claims were related to insurmountable curbs, lack of sidewalks from the crosswalk to the space reserved for handicapped in parking, excess slope on various ramps, and sand shortcuts.

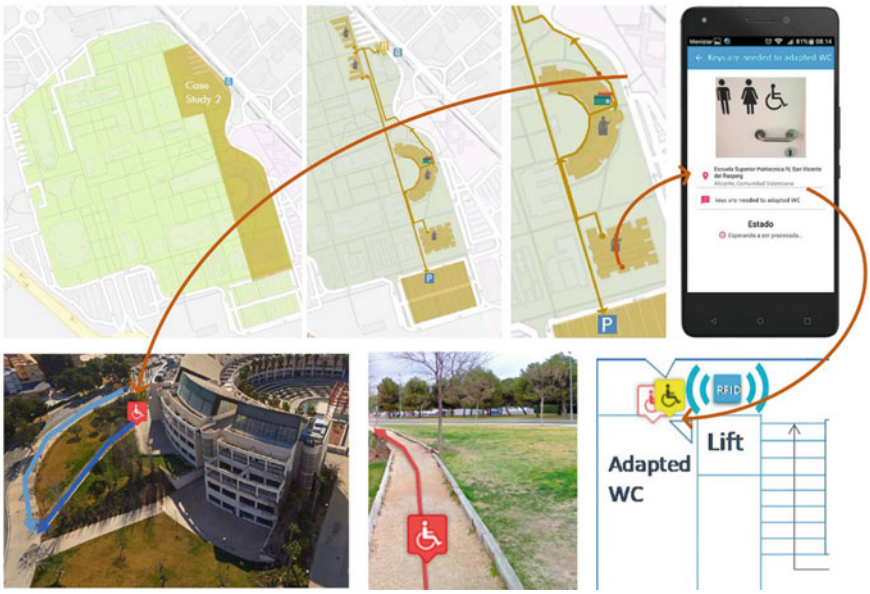

Fig. 7 Sample of case study 2. *Source* The authors

Some of these barriers require a process of construction work but others simply require the displacement and relocation of furniture, so the accessibility barrier could be solved immediately. From the point of view of city administrators, our proposal allows the implementation of a more participatory and inclusive accessibility management, in addition to a more effective and visible management offering fast solutions to specific problems that come quickly to society.

The second experimentation (case study 2) (Mora et al., 2017) was developed in the eastern area of the campus, specifically it started inside the Building 0039 shown in Figs. 5 and 7, and it was extended to the analysis of the most common exterior routes of students, teachers and university services staff. To carry out the evaluation in the indoor scenario, two RFID-based acquisition components were installed on the first floor of the building. This indoor experimentation enabled to detect deficiencies derived from the use of the building, specifically the use of the adapted toilet located in first floor. In addition, the experience developed in Building 0039 identified non-inclusive routes to access the basement where half of the building's classrooms are located. Most students follow the ramp to go down to basement level, but the ramp is too steep and all the participants with reduced mobility chose an alternative elevator route to avoid the ramp. The development of the experience allowed to give voice to all the users who live daily with this accessibility problem and the non-inclusive feeling. Once the accessibility claims inside the building were noticed, routes commonly used by all university groups on a normal day to other buildings continued. The UA Accessibility App was used along with RFID acquisition components that were placed at the entrances to the buildings. Some of the reported problems

were inaccessible curb at the entrance of the Building 0014 and Building 0015, heavy door preventing access to Building 0030, a road with stones that prevents the use of wheelchairs, or sand shortcut to administrative services building that also prevents the use of wheelchairs. Likewise, different routes followed by people with and without reduced mobility were detected to reach an identical destination. These differences that impede social inclusion are materialize in a complete list of problems that will serve as a source of information to identify and prioritize actions. These detections allow the administration to become aware of routes that are comfortable for citizens that were not initially planned, and to transform those routes into both accessible and inclusive. Therefore, the identification of new user habits makes it easier for the Administration to adapt new routes and new uses that were not originally planned in the urban plans. In short, these solutions that are possible through the ICT allow to equip the urban planning of a greater flexibility incorporating the participation and the inclusion of all the citizens in the decision making. Therefore, the proposal supports one of the main current challenges of urban planning processes that require greater flexibility and greater inclusion of all citizens in their planning.

Finally, this case study also helped us to verify that the combination of GPS and RFID technologies allows the detection of situations in heterogeneous areas where not all acquisition alternatives are available.

Similarly, the third experience (case study 3) was developed in the north area of the university campus (Figs. 5 and 9). One of the main novelties was the identification of unforeseen citizens' behaviours, which allows to detect other unexpected consequences related to the conception of accessibility of the urban environment as a whole, beyond the individual components (buildings, facilities, parks) (Pérez-delHoyo et al., 2019). The case study developed allowed us to evaluate the operability of the Alicante University urban environment regarding the integration of recently constructed buildings in the new university expansion areas. Specifically, we analysed the new Building 0702 located outside the closed perimeter of the campus, separated from it by a public main road. Building 0702 was built in 2013, with an investment of approximately 20 million euros and an area of 20,000 square meters. The building interior presents a fully accessible design with ample spaces for manoeuvring, close and inclusive interior itineraries, comfortable elements such as motion detectors for automatic light, "push to open" doors systems in adapted toilets, as well as furniture fully adapted to the needs of the people with reduced mobility. It is undoubtedly one of the most accessible buildings on the University of Alicante campus. However, despite the large investment made, we detected after carrying out the case study 3 that the environment in which it operates minimizes the accessible nature of the building design. The uncomfortable and inaccessible outdoor environment reduces the degree of real social inclusion of the building, causing unexpected users behaviour at certain points and routes. Several inaccessible points were detected. These inaccessible points prevent students with mobility disabilities from having a full integration in university social life. Some of these claims have their origin in the use phase of the building. A clear example of this is the direct access to parking spaces exclusively for people with reduced mobility in Building 0702 (Fig. 8). This parking is located at the back of the building in a design intended as the shorter itinerary, but in the use phase

of the building this access has been established as a fire exit so doors are blocked and therefore not accessible from the outside. As a consequence, the access to the building from that point translates into a much longer and different route than the one from the general parking of the building. Moreover, this alternative route is further uncomfortable considering the absence of shadows in a Mediterranean climate.

With this Integrated Accessibility Management System, it is also possible to detect unexpected functioning with respect to the expectations that were held when they were planned. Once these unexpected consequences are detected, the administration can improve and readjust the planning with a dynamic and real adaptation. The system allows making decisions based on the information provided by citizens and acting in two different moments of time, with the initial planning but also when the space is already in operation to reverse situations that have not met the initial expectations that had been marked with initial planning. It allows administrations to

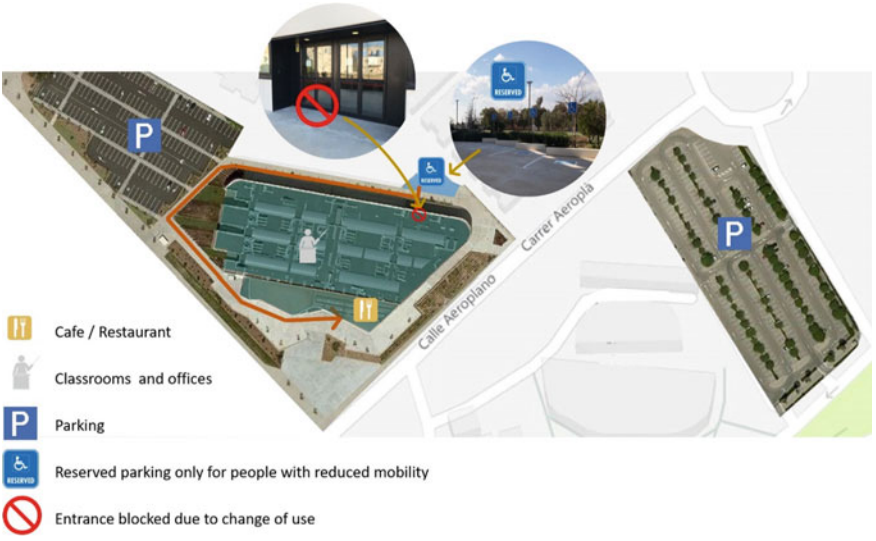

Fig. 8 Unexpected barriers in the use phase of the building and its surroundings. *Source* The authors

Fig. 9 Sample of case study 3. *Source* The authors

warn if the planned expectations have been met and consequently vary or introduce elements so that those initial expectations can actually be met.

In addition, the building's connections with the usual university facilities have several inaccessible and uncomfortable points that prevent the full integration of students with reduced mobility. Some of them are long routes that end in inaccessible curbs with no access, which require a return to the starting point and a search for a different itinerary. The absence of information for people with reduced mobility was also observed on the information panels. The summary figure of case study 3 is shown above.

Finally, the experiment was transferred to the city of Alicante (Spain) (Pérez-delHoyo et al., 2018), specifically to the Benalúa neighbourhood (Figs. 2 and 11), with the aim of determining the degree of social inclusion in the neighbourhood. The Benalúa neighbourhood is a residential area located one kilometre from the Alicante town centre. In relation to the facilities, the neighbourhood hosts many public services and facilities that serve the entire city of Alicante as the national police, courts or water service. As Fig. 10 shows, the case study focused on the path to all these public services and other routes from its most significant square to carry out daily activities in a normal day in the neighbourhood, such as go out for a drink, go shopping, or withdrawing money from banks.

The case study began in the central square which was crossed over to the nearest bank branch, and then continued to the Alicante courts. Then, a second route continued from that point to the supermarket with the largest influx of people in the area. Finally, the itinerary continued to some municipal services, specifically the water service and the municipal police building. During the route, inaccessible points were identified among the different connections in the neighbourhood, all the information was saved by the Urban Accessibility Information Service and KAIs were categorized.

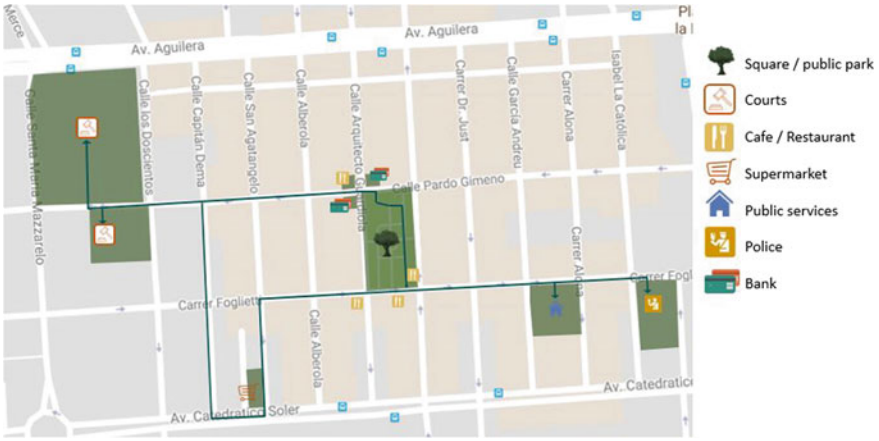

Fig. 10 Routes followed in case study 4 developed in Benalúa neighbourhood. *Source* The authors

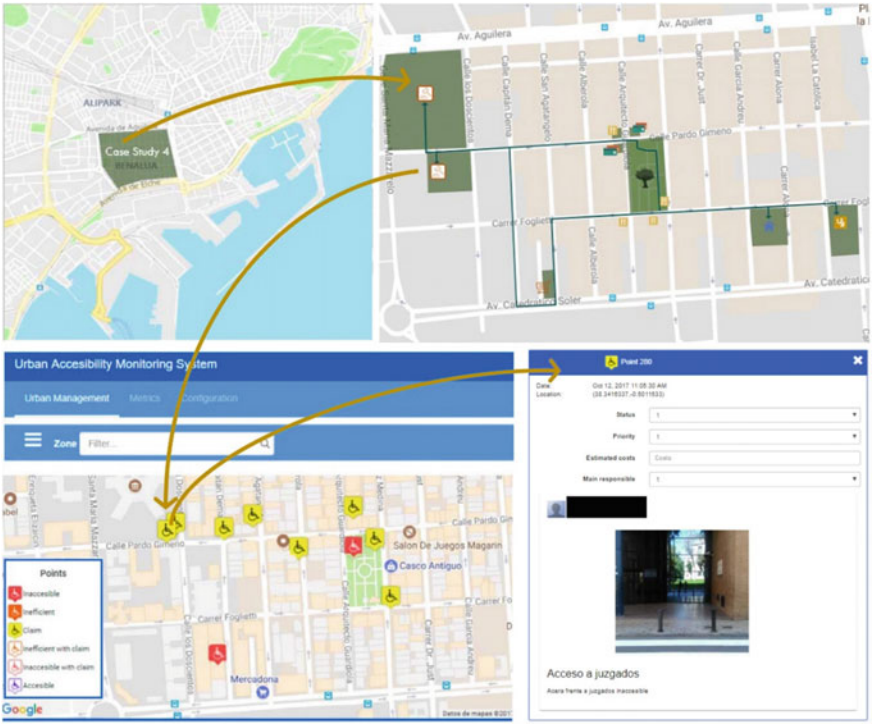

Fig. 11 Sample of case study 4. *Source* The authors

5 Implication

The current development and maintenance of cities requires urban policy makers and planners with an understanding of social implications to created inclusive urban environments. In terms of city management and policy-making, strategic solutions are needed to integrate the humanization of cities and efficient decision-making. Managing the challenges of urban growth and planning in today's society requires new approaches capable of detecting the needs of citizens, to obtain an updated knowledge of problems and priorities. The present proposal will allow the managers involved to deal with real life issues, allowing to approach tangible objectives that will have a direct visibility in the society. This rapid detection-action requires integration of citizen participation that facilitates real data collection and ICT deployment not only for the analysis of the urban user's experience but also to ensure a fast and reliable communication channel between citizens and city administrators. Furthermore, the proposal supports one of the main current challenges of urban planning processes in terms of flexibility for the dynamic re-adaptation of urban planning in changing situations throughout its use and greater citizen inclusion.

6 Conclusions

This research has allowed us to validate the benefits of the synergy of the use of new technologies and the information provided by citizens themselves, which allows to meet the real needs of people with movement disabilities in a dynamic way. The experimentation carried out to validate the proposed methodology included four case studies in different locations, three of them were carried out in different backgrounds at the University of Alicante, and the last sample was extended to a fourth case study to identify the degree of inclusion in one of the neighbourhoods of the city of Alicante.

The experiments carried out on the university campus analysed the daily journeys of the students, teachers and university services staff through the campus (outdoor routes) and their movements inside the buildings (indoor). Numerous inaccessible points were detected both inside the buildings and on the exterior routes to other buildings and areas of the campus, which are relevant for integration into university social life. In addition to the Accessibility App, some on-campus case studies incorporated RFID-based acquisition components located inside buildings. In this sense, experimentation has allowed obtaining information on the needs, habits and preferences of students, teachers and university services staff. It has also facilitated the identification of non-inclusive routes, verifying user integration as a fundamental active element and positioning the urban accessibility monitoring system as an effective channel for giving voice to people with and without disabilities.

The extrapolation of the experimentation to the urban environment of the Benalúa neighbourhood in the city of Alicante has allowed us to identify the degree of inclusion of the area. Furthermore, it has allowed us to ensure the effectiveness of citizen participation and to verify how, through technology, the citizen is positioned as a starting point in the cyclical process to achieve Smart cities, with the capacity to respond to the needs of their community. This direct information of the citizen carried out through the ICT deployment allows us both to know the information related to existing incidents in terms of accessibility, and its monitoring over time. Therefore, this research contributes to the creation of a continuous communication channel between citizens and public administrations, promoting not only social inclusion but also a sense of identity and belonging to the neighbourhood. This feeling generates a greater interest of citizens in the problems of their city that will improve both social cohesion and the quality of life of the citizen in general.

References

Alfaro Navarro, J. L., López Ruiz, V. R., & Nevado Peña, D. (2017). The effect of ICT use and capability on knowledge-based cities. *Cities*, *60,* 272–280. https://doi.org/10.1016/j.cities.2016.09.010

Chourabi, H., Nam, T., Walker, S., Gil-Garcia, J. R., Mellouli, S., Nahon, K., Pardo, T. A., & Scholl, H. J. (2012). Understanding smart cities: An integrative framework. In *45th Hawaii International Conference on System Sciences, Maui, HI* (pp. 2289–2297).

Colantonio, A., & Dixon, T. (2011). *Urban regeneration and social sustainability: Best practice from European cities*. Wiley.

Dameri, R. P. (2017). *Smart city implementation: Creating economic and public value in innovative urban systems*. Springer.

Del Hoyo, R. P., & Lees, M. (2018). Redefining the smart city concept: the importance of humanizing 'intelligent' cities. In E. U. P. de València (Ed.), *24th ISUF International Conference Book of Papers* (pp. 865–872). https://doi.org/10.4995/isuf2017.2017.5982

European Commission. (n.d.). *Market place of the European innovation partnership on smart cities and communities*. Retrieved June 10, 2017, from https://eu-smartcities.eu/

European Commission. (2010). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. European Disability Strategy 2010–2020: A Renewed Commitment to a Barrier-Free Europe*. Retrieved June 11, 2017, from http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52010DC0636&from=ES

Glasmeier, A., & Christopherson, S. (2015). Thinking about smart cities. *Cambridge Journal of Regions, Economy and Society*, *8*(1), 3–12. https://doi.org/10.1093/cjres/rsu034

Lytras, M. D., & Visvizi, A. (2020). Information management as a dual-purpose process in the smart city: Collecting, managing and utilizing information. *International Journal of Information Management*. https://doi.org/10.1016/j.ijinfomgt.2020.102224

Lytras, M. D., Visvizi, A., Chopdar, P. K., Sarirete, A., & Alhalabi, W. (2020). Information management in smart cities: Turning end users' views into multi-item scale development, validation, and policy-making recommendations. *International Journal of Information Management*. https://doi.org/10.1016/j.ijinfomgt.2020.102146

Mora, H., Gilart-Iglesias, V., Pérez-Del Hoyo, R., & Andújar-Montoya, M. D. (2017). A comprehensive system for monitoring urban accessibility in smart cities. *Sensors (Switzerland)*, *17*(8). https://doi.org/10.3390/s17081834

Mora, H., Gilart-Iglesias, V., Pérez-Delhoyo, R., Andujar-Montoya, M. D., & Compañ Gabucio, H. J. (2016). Interactive cloud system for the analysis of accessibility in smart cities. *International Journal of Design and Nature and Ecodynamics*, *11*(3). https://doi.org/10.2495/DNE-V11-N3-447-458

Neirotti, P., De Marco, A., Cagliano, A. C., Mangano, G., & Scorrano, F. (2014). Current trends in smart city initiatives: Some stylised facts. *Cities*, *38*, 25–36. https://doi.org/10.1016/j.cities.2013.12.010

Pearce, J. (2010). *Participation and democracy in the twenty-first century city*. Springer.

Pérez-Delhoyo, R., Andújar-Montoya, M. D., Mora, H., & Gilart-Iglesias, V. (2017). Urban and building accessibility diagnosis using 'accessibility app' in smart cities a case study. In *SMARTGREENS 2017—Proceedings of the 6th International Conference on Smart Cities and Green ICT Systems*.

Pérez-delHoyo, R., Andújar-Montoya, M. D., Mora, H., & Gilart-Iglesias, V. (2018). Citizen participation in urban planning-management processes assessing urban accessibility in smart cities. In *SMARTGREENS 2018—Proceedings of the 7th International Conference on Smart Cities and Green ICT Systems* (Vol. 2018-March).

Pérez-delHoyo, R., Andújar-Montoya, M. D., Mora, H., & Gilart-Iglesias, V. (2019). Unexpected consequences in the operation of urban environments. *Kybernetes*, *48*(2). https://doi.org/10.1108/K-02-2018-0096

Rathore, M. M., Paul, A., Ahmad, A., & Jeon, G. (2017). IoT-based big data: From smart city towards next generation super city planning. *International Journal on Semantic Web and Information Systems (IJSWIS)*, *13*(1), 28–47. https://doi.org/10.4018/IJSWIS.2017010103

Rudnick, S. K. K. (1980). *Problem solving in school mathematics. MEPS Technical Report 84.01* (National c). Year Book.

United Nations. (2006). *Convention on the rights of persons with disabilities*. Resolution 61/106.

Uribe-Pérez, N., Hernández, L., de la Vega, D., & Angulo, I. (2016). State of the art and trends review of smart metering in electricity grids. *Applied Sciences*, *6*(3), 1–24. https://doi.org/10.3390/app6030068

Visvizi, A., Mazzucelli, C. G., & Lytras, M. (2017). Irregular migratory flows: Towards an ICTs' enabled integrated framework for resilient urban systems. *Journal of Science and Technology Policy Management*, *8*(2), 227–242. https://doi.org/10.1108/JSTPM-05-2017-0020

Yigitcanlar, T., & Han, J. H. (2010). Ubiquitous eco cities: Telecommunication infrastructure, technology convergence and urban management. *International Journal of Advanced Pervasive and Ubiquitous Computing 2*, 1–17.

Raquel Pérez-delHoyo, Ph.D., Associate Professor, University of Alicante, Alicante, Spain. Her research interest include urban planning, smart cities, and inclusive cities.

María Dolores Andújar-Montoya, Ph.D., Associate Professor, University of Alicante, Alicante, Spain. Her research interests include the built environment in connection to design and accessibility.

Higinio Mora, Ph.D., Professor, University of Alicante, Alicante, Spain. His research interests include blockchain, smart contracts, smart cities, internet of things and cloud computing architectures.

Virgilio Gilart-Iglesias, Ph.D., Associate Professor, University of Alicante, Alicante, Spain. His research interest include process automation, distributed systems, smart cities, internet of things and cloud computing architectures.

Rafael Mollá-Sirvent, Adjunct Professor, University of Alicante, Alicante, Spain. His research interests include mobile applications, cloud computing and internet of things.

Towards a Smart City in the Tropics: The Malaysian Approach

Marek Kozlowski and Yusnani Mohd Yusof

Abstract Since the 1980s the major cities in Malaysia have witnessed a spate of urban redevelopment including institutional, office, and mixed-use complexes, shopping malls, educational establishments, and residential neighbourhoods. The current urban makeover in Malaysia is mainly market-driven and characterised by fast-track development, emphasis on catalyst megaprojects, infrastructure and global connections. Such an approach is often contrary to the basic principles of a smart city concept. This chapter provides a deeper understanding of the complexity of changing urban landscapes in Malaysia strongly influenced by globalisation and neoliberalism. By selecting three cities: Kuala Lumpur, Kota Kinabalu and Melaka, the objectives of this study address the development patterns in these cities and evaluate how innovative and sustainable policies are applied to solve urban problems and achieve better smart city status. To this end, qualitative research methods such as literature review, qualitative analysis, secondary data collection, field surveys, and observations are employed. This study provides a deep insight analysis and evaluation of urban development in Malaysia and highlights the conflict between economic growth and progress and the principles of sustainable and smart urban environments. The outcomes of this study identify gaps in urban planning and management mechanisms that are essential for Malaysian cities to achieve a smart city status.

Keywords Urban transformation · Fast track development · Globalisation and neoliberalism · Smart city status · Tropical climate-responsive environment

M. Kozlowski (✉)
Faculty of Design and Architecture, University Putra Malaysia, Seri Kembangan, Malaysia
e-mail: m.kozlowski@upm.edu.my

Y. M. Yusof
Centre for Advanced Research, University Brunei Darussalam, Bandar Seri Begawan, Brunei

A. Visvizi and O. Troisi (eds.), *Managing Smart Cities*,
https://doi.org/10.1007/978-3-030-93585-6_3

1 Introduction

Many cities around the world have been in fierce competition to reach the desired smart city level. The key findings of this study revealed that the major gaps in achieving smart city status in the selected Malaysian cities are in the fields of sustainable regional and local urban planning, transport planning, urban design, urban infrastructure and urban management.

However, firstly it is imperative to define what is understood as a smart city. According to Dameri (2013), Emeria et al. (2017) the comprehensive definition of a smart city concept should take into consideration elements including components, geographical boundaries, scope and terminology. Dameri (2013) further argues that the basic characteristics of a smart city refer to an urban environment that is made by land, citizens, technology and governance. A smart city can have larger or broader boundaries, ranging from the local urban dimension of a single city to a region, a network of cities, and finally towards a national and global dimension. It should have well defined and measurable goals, regarding aspects including; environmental sustainability, the creation of smart intellectual capital, citizens participation and well-being. A smart city has to be intelligent, digital, sustainable, inclusive, and democratic, and should relate to intelligent, digital, sustainable techno and well-being city concepts (Dameri, 2013; Emeria et al., 2017). An intelligent city is a city that has several competencies, able to produce knowledge and to translate it into unique and distinctive abilities. The digital city refers to using ICT both for data processing and for information sharing. A strong interrelation between a smart city and IoT (Internet of things) a system that integrates different devices and technologies has been identified by Shah Syed et al. (2021) A sustainable city aims to be a green city that uses technology to reduce CO_2 emissions, produces efficient energy, and improves overall building efficiency. A techno smart city is a city that uses technology to improve the efficiency and effectiveness of its infrastructures and services including public transport and provision of quality public space. A well-being city aims to produce the best quality of life for its citizens, and also to create regional attractiveness both for people and for business (Dameri, 2013).

The transformation of large metropolitan areas in Southeast Asia presents a challenge to governments, decision-makers and urban planners. The new development in Southeast Asia is emerging at an enormous paste having a detrimental impact on the traditional urban fabric (Hamnet & Forbes, 2011). This trend has opened an ongoing urban discourse on the future global urban outcomes. Similar to other cities in Southeast Asia, major cities in Malaysia are successful in attracting global enterprises and conducting large scale urban projects that improve the quality of the urban infrastructure (Kozlowski & Mohd Yusof, 2018). They also attracted a large number of visitors and tourists that contributed to their local economies. Although international trade development and tourism have improved the global standing of major cities in Malaysia, this achievement is often not parallel in terms of progress towards a smart city status.

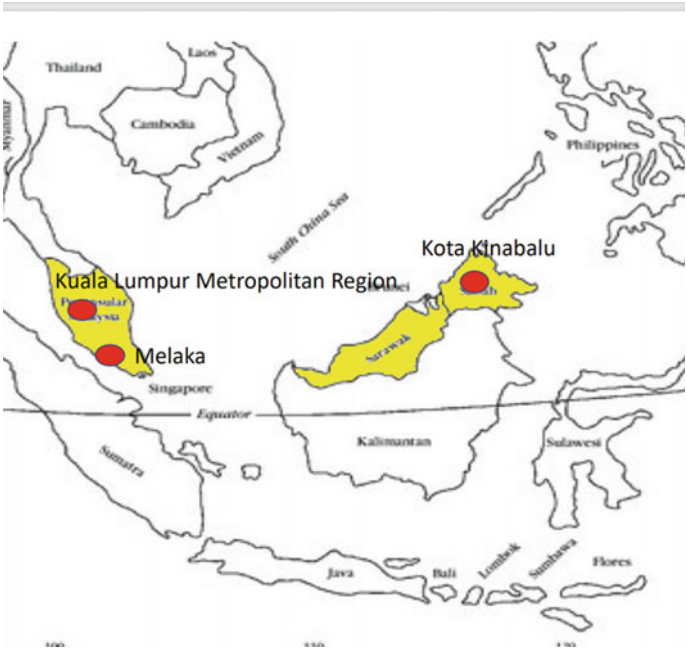

Fig. 1 Location of the three selected cities. *Source* Authors

The current risks and threats resulting from climate change and pandemics require a rethink of the contemporary development trends. It is essential to re-evaluate the outcomes of the existing development paste in Malaysian cities. In this study three Malaysian cities are examined, i.e. Kuala Lumpur, the nation's capital, and Kota Kinabalu and Melaka, both rapidly emerging regional centres (see Fig. 1).

This research attempts to address a gap in professional literature targeting smart city achievements in Malaysia. The selected case study areas include three different cities. Kota Kinabalu is a state capital and an important tourist hotspot. The KLMR is one of the major urban conurbations of Southeast Asia, and Melaka is a UNESCO listed historic city.

The study contains two parts. The first part describes the urban environments in the selected cities and further identifies adopted planning strategies and policies. In the second part, the current sustainable policies and strategies are analysed and evaluated against the basic principles of a smart city concept.

2 Methodology

The research adopted a multi-dimensional approach to urban planning analysis. The qualitative research methodology in data collection involves conducting extensive literature including the review of the growth of the three cities, its phenomenon and reaction from the local, state and federal authorities. Besides, applied methods include documentary research and policy analysis. A large portion of this study is based on secondary data sources, professional literature and journals. The secondary data sources include literature review originating from books, journal articles, produced by international and local scholars.

A substantial amount of information regarding the case study areas derives from government and non-government web links including local planning documents. Primary data collection includes field surveys, observations and a structured interview. Information deriving from questionnaire surveys, and interviews conducted by the authors in previous research projects is also included in this study.

The case study approach applied in this study resonates Yin (2003) who indicates that it allows for a better understanding of the physical, and non-physical phenomenon.

3 Case Studies and Discussion

3.1 Kota Kinabalu

The current population of the city of Kota Kinabalu (KK) is 460,000. The city area of 351 km^2. The Greater KK area has a population of 870,000 and an area of 3,277 km^2 (Kota Kinabalu District, Malaysia, 2019). The Greater KK conurbation has a linear urban structure stretching 68 km along the South China Sea coastline from the south to the north with Kota Kinabalu being the primary urban centre (Kota Kinabalu District Malaysia, 2019; Property Hunter, 2014, 2019).

A map of the greater KK area is shown in Fig. 2.

Since the 1990s Malaysia has followed the main precepts of neoliberalism which had an impact on the urban form and structure of the cities. Due to the large influx of tourists and international investors, its appealing coastal location and surrounding natural attractions Kota Kinabalu was heavily influenced by neoliberalism and property led development. Property prices in Kota Kinabalu are one of the highest in Malaysia (Numbeo, 2019). An average price of an apartment in the central parts of the city is around 10,700 RM (2000 USD) per square meter. That is more expensive than other major Malaysian cities including George Town, Penang and Johor Bharu. Yet the property price to average income ratio in KK is 17 making the city the least affordable of all cities in Malaysia (Numbeo, 2019) and less affordable than comparable size cities in Europe, the USA and Australia. where the property/income ratio index varies between 5 and 12.

Fig. 2 Greater KK area. *Source* Authors

Neoliberalism and property led development had a major impact on the urban landscape of Kota Kinabalu. The rapid development has swallowed a large amount of pristine natural environments which were always a major element of Kota Kinabalu's city landscape. The land directly along the waterfront has been leased out for speculative commercial development at the cost of valuable public recreational space. As a result, Kota Kinabalu does not have a public waterfront promenade although its central areas are located directly along the water. Instead of a pedestrian-friendly boulevard with visual and physical connectivity to the water, the major central street Jalan Tun Faud Stevens, developed on reclaimed land, resembles a heavily trafficked arterial jammed with cars and flanked by on both sides by featureless and non-tropical climate-responsive built form. The lack of adequate streetscaping and tree planting only adds to the non-tropical and non-climate responsive ambience of the surrounding urban environment. Figure 3 shows existing streetscapes in the central of Kota Kinabalu.

Planning and urban management of the city of Kota Kinabalu are coordinated by Kota Kinabalu City Council Urban Planning and the development control for the city is guided by Kota Kinabalu Structure Plan 2030 and the Draft KK Local Plan 2020.[1] Draft Kota Kinabalu Local Plan 2020 has sufficient policies addressing the preservation of heritage buildings and the natural environment. The main premise of this Plan is to make the city liveable for the residents and attractive for the visitors, Edge Prop, 2017).

The major aim of the DBKK and the Local 2020 Plan is to promote development on the current prime brownfield sites within the existing urban footprint. This approach is

Fig. 3 Existing streetscapes in Kota Kinabalu-lack of tropical character and substandard quality. *Source* Authors

aimed at halting further urban sprawl by promoting development within the existing urban footprint. To fulfil this housing development requirement and demand, the DBKK wants to increase the population within these prime areas (Property Hunter, 2019).

The planning and development of Greater KK is coordinated by the Sabah State Government with the cooperation of local authorities including DBKK. There is no regional plan for the Greater KK area. In addition, there is no regional body coordinating the development in this growing urban area (Sabah Development Board and Investment Authority, 2019).

The state government has tried to address planning deficiencies, as the Sabah Town and Regional Planning Department has come out with a draft of the Sabah Structure Plan 2033. As part of this Plan, the state government aims to improve public transport in Kota Kinabalu by introducing the light rail transit and bus rapid transit (BRT) system. The current public transport system in KK is inadequate. It is based on an irregular bus service system (Edge Prop, 2017).

A major step towards achieving a better smart city status is the Kota Kinabalu Green City Action Plan (KKGCAP). This environmental program of KKGAP aims to transform Kota Kinabalu into a nature resort city. The overarching goal is to create a city that is clean, green and liveable.

Kota Kinabalu will be the first city in Malaysia to have its GCAP. KKGCAP will support Malaysia's National Urban Policy and help in meeting the State of Sabah and Malaysia's climate and green growth commitments. The vision of Kota Kinabalu is to realise a nature resort city; a clean, green and liveable city based on physical characteristics, economic advantages, and local culture by 2020. This vision will be achieved by focusing on four key parameters: services, cleaning, enforcement and development (Asia Development Bank, 2019).

The KK-GCAP preparation process is planned to be in three essential phases: mobilization, analysis, and project preparation. This involves establishing the baseline for urban development in the city, including developing an economy-wide GHG emissions inventory and conducting a climate vulnerability assessment. In response to the GCAP, the local authorities and stakeholders have identified the potential priority projects for implementation through GCAP (Asia Development Bank, 2019).

The new planning documents including the KK GCAP and the new local plan have just been launched therefore it's too early to witness any visible outcomes deriving from their implementation. Until now urban planning in KK has been dominated by master-planned tourism and mixed-use complexes which only contribute to the expansion of quality private realm and exclusive utopian environments. Smart planning initiatives have only resurfaced in the city and it will take some time before one can see any tangible results.

Kota Kinabalu was severely hit in 2020 by the COVID pandemic. The Malaysian Government closed the borders in March 2020 and banned tourists from all over the world from visiting the state. Being an open economy where the international trade and tourism sector is one of the most important contributors, the COVID pandemic and the closure of the national and later state borders were a blow to Sabah's economy largely dependent on tourism. A questionnaire survey conducted by Idris et al. (2020) and involving 100 workers of hotels in Kota Kinabalu, Tawau and Sandakan, Sabah, revealed that a large percentage of them agreed that the pandemic had a major impact on the hotel industry in the state. The COVID crises parallel with the lack of a clear roadmap for the recovery of the tourism sector will no doubt further delay any significant progress on KK achieving smart city status.

4 Kuala Lumpur

The Kuala Lumpur Metropolitan Region is a major urban conurbation of Southeast Asia. The city administrative area has a population of 1.7 million and an area of 243 km^2. The population of the Kuala Lumpur-Klang Metropolitan Region, covering an area of 2790 km^2, is 7.7 million (World Population Review, 2018) (refer Fig. 4).

The city's beginnings were strongly associated with the tin mining industry. The first settlement of Kuala Lumpur as a trading post for tin mining was established by Raja Abdullah in 1857 at the confluence of the Klang and Gombak Rivers (Seng Fatt, 2004).

According to Kozlowski et al. (2020), Kuala Lumpur since its independence in 1957 experienced three distinct development periods; the post-independence period, the Mahathir era and the twenty-first century march towards a global city.

In the post-independence period, as a result of the demographic imbalance, the new Federal government made efforts to change the ethnic proportions and encourage the Malay population to settle in Kuala Lumpur. Since the 1960s, the amount of Malay population in Kuala Lumpur and the surrounding new urban centres has significantly increased (Baker, 2008).

Fig. 4 Kuala Lumpur Metropolitan Region (KLMR). *Source* Authors

The Mahathir era corresponding to the period when Malaysia was governed by Prime Minister Tun Mahathir (1981–2003), witnessed rapid development in Kuala Lumpur and the surrounding area. The major developments that took place in the 1990s included Kuala Lumpur City Centre (KLCC), Kuala Lumpur International Airport (KLIA) and the Multimedia Super Corridor comprising Putrajaya (the new administrative capital of Malaysia) and the multi-media city of Cyberjaya. All three developments had a profound impact on reshaping the image of the newly developing Kuala Lumpur agglomeration. The new Kuala Lumpur International Airport was a necessity to improve the international links with Malaysia.

The post-Mahathir period has been influenced by global neoliberal trends resulting in property led to fast-track development. Globalisation and neoliberal policies became the main economic driver behind the development of Kuala Lumpur and its surrounding urban conurbation. Globalisation triggered economic growth, substantial improvement of the urban infrastructure and increased the living standards of the residents. However, this global transformation also brought negative side effects. They included environmental degradation, a decline of safety and security, rapidly increasing property prices and the diminishing of the traditional urban fabric. In terms of architecture, the vernacular regional styles typical for the 1980s and 90s were gradually replaced by universal modern design or abstract approach to regionalism which responsed to new technologies, materials, conventions and the scale of buildings (Kassim et al., 2017).

The post-Mahathir era also witnessed the establishment of the Greater Kuala Lumpur also called the Kuala Lumpur Metropolitan Region or the KL Klang Valley. The area of KLMR covers 10 municipalities including Kuala Lumpur (KLMR), Putrajaya, Shah Alam, Petaling Jaya, Klang, Kajang, Subang Jaya, Selayang Ampang

Jaya and Sepang (International Urban Development Association, 2015). The urban structure of the metropolitan region is polycentric and based on a hierarchal distribution of centres connected by a network of transport corridors very similar arrangement to a typical model of an American post-industrial city. However, the city of Kuala Lumpur is still the prime globalised centre and with the highest intensity of multinational companies, prominent landmarks and activity nodes (Kozlowski & Mohd Yusof, 2018).

Since the 1990s urban development in the Kuala Lumpur Metropolitan Region has followed the global trends and was influenced by the principles of neoliberalism. This resulted in property-led development, which has become one of the main drivers of the national economy. The lack of regional physical planning and coordination has led to urban sprawl and degradation of character areas and neighbourhoods. Many traditional inner-city neighbourhoods experience decay and are often overshadowed by overhead road infrastructure. The lack of a regional plan for the entire KLMR region informing all the local plans is a constraint severely limiting the possibility of developing a smart urban conurbation. Car ownership in KL is the highest in Malaysia with over 90% of household owning a car. Motor vehicle emissions are the leading cause of pollution in KL. While road transportation continues to be the dominant mode of transport, public transport is gradually becoming more popular and will be an essential feature in the growth of KLMR (SPAD, 2018). Existing public transport facilities in the KLMR are shown in Fig. 5.

One of the main precepts of a smart city is an efficient, sustainable and well-functioning urban infrastructure. The urban infrastructure in the KL region has witnessed a semi-privatisation of primary municipal services including waste and water management's energy supply, and telecommunication services follow the trends and practices of other major cities around the World. The current water and waste management systems are still far from achieving an enclosed sustainable loop. The majority of waste is not recycled, and the grey and storm-water are not fully reused. Although DBKL, the Federal and State Governments are committed to the introduction of sustainable urban infrastructure; the existing deliverables are limited to pilot projects and lengthy planning reports (Kozlowski et al., 2020).

Fig. 5 Existing public transport facilities in the KLMR. *Source* Authors

Fig. 6 The planned city of Putrajaya with vast areas of green open space. *Source* Authors

Over the last 20 years, Putrajaya has grown to a city of almost 100,000 population. The new administrative capital of Malaysia is a well-planned city with the government precincts centred around the main boulevard and located in the vicinity of an artificial lake. However, the planning of Putrajaya was following the orthodox methods promoting the separation of land uses. Although 38% of Putrajaya constitutes green open space and the city is equipped with underground services including wireless broadband, it cannot be labelled as a model smart city because it is car-dependent deprived of an internal rapid transit system. Cyberjaya is located next to Putrajaya. It is Malaysia's first Cybercity designated as a special zone with the entrepreneurs and multinational companies provided with a package of tax incentives (Cyberjaya, 2019; King, 2008). Similar to Putrajaya, Cyberjaya is also car-dependent. The planned administrative capital of Putrajaya is shown in Fig. 6.

The local authorities, the Federal Government and the state government of Selangor have introduced planning measures to address the urban form and functioning of the metropolitan region. For example, Kuala Lumpur has a series of planning documents including the 2020 Local Development Plan and other supporting strategies and guidelines such as 'A Greener and Better KL', 'Master Plan for Kuala Lumpur City Competitiveness' and the 'The Urban Design Guidelines for Central Kuala Lumpur' (DBKL, 2012, 2014, 2018).

One of the significant achievements of the Federal Government was the regional approach to public transport and the establishment of The Land Public Transport Authority SPAD (SPAD, 2016). The public transport system has is being developed in the KLMR since 1998. Currently, the public transport system in KLMR is regarded as one of the most advanced in the ASEAN region, falling only behind the one in Singapore.

DBKL has recently launched the 2040 Draft Kuala Lumpur Structure Plan. The main objectives of this plan are to create a sustainable, pedestrian-friendly, community-oriented smart city within the next 20 years. The Plan addresses important elements of a sustainable and smart city including innovative and productive growth, inclusiveness and equitability, healthy and vibrant urban environment, achieving a low carbon and climate-smart city, an environmentally mobile city and

creating a city of integrated and sustainable development (DBKL, 2020). However, this ambitious Plan is limited to the physical boundary of the city of Kuala Lumpur and does not address the entire regional context of the metropolitan area. A regional strategy for the entire urban conurbation has not been yet prepared. Lessons learned from urban agglomerations in Europe, Australia and North America indicate that regional plans and strategies are critical as they inform the local plans and overarching urban planning principles for all municipalities located in a particular region (Department of Infrastructure and Planning, Queensland Government, 2009; Seltzer, 2008).

Putrajaya has prepared the Putrajaya Green City 2025 Strategy. The Strategy is transforming the city through green initiatives in 7 focus areas: Integrating nature into the urban fabric, planning and building, transportation and mobility, energy usage, water usage, solid waste management, and the city administration and management (Perbadanan Putrajaya, 2012).

5 Melaka

The city of Melaka, capital of the state Melaka, has a population of 579,000 and covers an area of 277 km^2 (Department of Statistics, Malaysia, 2021) (refer Fig. 7).

Melaka is unique in Malaysia as it is the only city that was ruled by three colonial powers including the Portuguese, the Dutch and the British (Vis, 2007).

Until the 1950s Melaka had a unique location with the port zone and the city centre located directly along the Straights of Melaka. This was a typical model for the location of most coastal cities in Southeast Asia in the late 19th and early twentieth century (Pacione, 2005). Post-independence things took a drastically different turn.

Fig. 7 The city of Melaka and surrounds. *Source* Authors

Since 1957 Melaka has started coastal reclamation for commercial and industrial spaces with the extensions of its foreshores (Bahrain & Teh, 1991). Since 1991, Melaka, Penang and Sabah, have been the pioneers in developing reclaimed coastal islands. Melaka has acquired more than 2,300 ha of reclamation areas until 2006 (Mohamed & Rizal Razman, 2020).

The rapid development and the demand for accommodation and infrastructure at the coastal areas in Melaka City have encouraged the state government to approve the reclamation projects. The reclamation projects are designated for the tourism infrastructure, hotels, residential houses, marina bays and a maritime museum (Mohamed & Rizal Razman, 2020).

Coastal reclamation has become the main issue for coastal development in Malaysia. Despite more land being created for economic activities, coastal reclamation has brought direct and indirect impact to the coastal environment. The impact includes environmental degradation, siltation and erosion problems and a threat to the marine flora and fauna. In the case of Melaka, reclamations have been detrimental to the unique character and sense of place of the city (Mohamed & Rizal Razman, 2020; Friends of Earth Malaysia, 2020).

One of the most recent ambitious projects was the reclamation of land for the development of the Melaka Gateway Project. The Melaka Gateway project is situated on reclaimed land at the edge of Melaka city centre (MelakaGateway 2020). The proposed project envisages a mixed-use commercial and leisure centre with a maritime industrial park and deep-sea port. It's a mixed-use project initiated by KAJ Development Sdn. Bhd comprises three reclaimed and one natural island totalling 609 ha. It is mainly targeting the tourist and visitors to Melaka. According to Airlan Admin (2014), the Melaka Gateway project set to turn Melaka from a historical jewel into nothing more than a playground for the rich. The Melaka Gateway project is situated next to the rival 8 ha Hatten City project. Airlan Admin (2014) further argues the project will create a muddy trash/sewage repository, especially when the tide is out, and will destroy the already fragile fishing grounds.

Due to a series of environmental concerns, the state government of Melaka decided to cancel the reclamation project that had been planned for three years. The construction of Melaka Gateway has been put on hold indefinitely (The Edge Markets, 2021).

Another reclamation project with disastrous consequences was the Pula Melaka project located next door to the Melaka Gateway project. The land was developed without any cost–benefit analysis or economic feasibility studies and as a result, the majority of the constructed commercial shophouses are vacant until today (10 years after the completion). All subsequent plans to develop the island have failed and Pulau Melaka today resembles an absolute ghost town (Airlan Admin, 2014). The 'ghost town' urban environment of Pulau Melaka is shown in Fig. 8.

On the 7th of June 2008, the United Nations Educational, Scientific and Cultural Organization's (UNESCO) World Heritage Committee has included Melaka, into the UNESCO World Heritage List.

The UNESCO listing encouraged the state and the city Melaka to endeavour on a series of urban regeneration and conservation projects. The most famous project

Fig. 8 The 'ghost town' urban environment of Pulau Melaka. *Source* Authors

was the regeneration of the historic Melaka Riverwalk in the old city centre. This project was an initiative of the Melaka State Government together with Melaka City Council (MBMB). The main impetus in the beautification and rehabilitation of the river corridor was to provide for flood mitigation and enhance the city's-built environment, tourism industry and economy. The beautification benefited the city environment and revitalised the historical city of Melaka as the oldest and, at one time, the most famous port east of India (Focus Architects and Urban Planners, 2006). The historic Meleka River Walk is shown in Fig. 9.

Like Kota Kinabalu, Melaka city has adopted the Green City Action Plan (GCAP), which targets city transformation into a low carbon city. In the GCAP, energy, transport and waste are given importance among other projects such as tourism and water management. The GCAP prioritises greenhouse gas (GHG) emission reductions in the energy sector by preparing a comprehensive energy plan and implementing demonstration projects that reduce energy consumption (Urban Pathways Melaka, 2021).

In terms of energy, Melaka is determined to reduce its GHG emissions by applying efficiency practices and increasing its use of renewable energy sources. In terms of waste management, Melaka aims to become a "zero waste" state while reducing its waste-related GHG emissions and preparing a waste management plan.

To improve its public transport Melaka aims to reduce its transport-related GHG emissions through the implementation of public transport and e-mobility. The city

Fig. 9 The historic Melaka Riverwalk. *Source* Authors

is focusing on the following: development of traffic regulating system, inclusive network of non-motorized transportation infrastructure, developing a transit plan for the city. Melaka is currently facing severe transportation problems, having very low numbers of non-motorized transportation users due to safety issues and unpredictable weather conditions, an increased number of private vehicles and an insufficient public transport system**.**

6 Key Findings

Since the 1990s Malaysia has followed the main precepts of neo-liberalism and gradually privatised the necessary urban services. Neoliberalism began to take root during the two decades of administration under Prime Minister Mahathir Mohamad and was continued under Prime Minister Abdullah Badawi and Najib Razak (Lim, 2017).

The three cities mentioned in this study have experienced urban sprawl which has a detrimental impact on the surrounding urban environment. The development and transformation of Kuala Lumpur and its surrounding region, since the Second World War had a similar pattern to the growth of other major capitals of Southeast Asia including Bangkok, Ho Chi Minh City, Jakarta and Manilla. All these cities

have expanded into major urban conurbations where physical development has been given preference over any urban community agendas. Like Phuket in Thailand, Kota Kinabalu and Melaka are dependent on tourism and as such its largely influenced by globalised markets.

Although neoliberalism has improved the living standards of ordinary citizens and contributed to the provision of quality infrastructure it has also interrupted the trajectory in achieving smart city status. One of the basic features of neoliberalism is fast track property led development which in its principles is contradictory to the objectives of smart city development.

The following section analyses the urban development and management approach and urban planning mechanisms in the KLMR, Kota Kinabalu and Melaka against the five concepts of a smart city as identified by Dameri (2013). The five concepts include intelligent city concept, digital city concept, sustainable city concept, techno-city concept and well-being city concept.

In terms of the intelligent city concept, only the KLMR with six major public universities supported by research centres and almost 59 private universities and tertiary education institutions can be classified as an emerging intelligent urban conurbation being able to provide knowledge and translate to other distinct abilities (Kozlowski et al., 2020). Although the number of universities and tertiary education establishments has increased in Kota Kinabalu and Melaka their number and scope of activities is insufficient for the two cities to be labelled as major educational hubs.

All three cities can classify as digital hubs with the information technology communication (ICT) used for processing data and communication. The ICT expanded during the COVID pandemic with the digital devices used for everyday activities such as food delivery and individual health screening.

All cities have embarked on a program to achieve sustainable development in the future. Kota Kinabalu and Melaka have prepared the Green City Action Plan with the main objectives targeting the provision of energy efficiency, reducing CO_2 submissions and delivering a sustainable waste and water management system. However, all the recommendations and tasks are still in the initial planning stage not followed by implementation directives. None of the cities has prepared a regional plan that could inform all the local plans and strategies delivered by the local authorities and government agencies. The introduction of the Green Building Index (GBI) in Malaysia, addressing residential, commercial and institutional development, is a step forward in achieving a more sustainable and climate-responsive built environment. The GBI encourages developers to promote tropical design, energy efficiency and sustainable waste and water management in their future developments. The GBI has contributed to the development of new green buildings especially in the KLMR region (Shari, 2015). All cities have experienced fast track development which is often contrary to the principles of sustainable development and does not reflect the tropical climate conditions. This fast-track development is conducted without supporting feasibility studies and design guidelines resulting in substandard built environments and the production of new ‘urban vacuums’ such as Pulau Melaka.

The techno-city principles related to the smart city concept have been partially fulfilled in the KLMR where since 1998 the first rapid transit system (the light

rail transit (LRT)) has been introduced. This system has been further expanded by regional Metro Rapid Transit (MRT) lines. MRT 1 was opened in 2017 while MRT 2 is currently under construction. There are no rapid public transit systems in Kota Kinabalu and Melaka, although both cities have drawn plans and strategies to introduce such a transport system in the foreseeable future. The provision of quality public spaces has been high on the agenda in major Malaysian cities. However, recent studies of urban design projects in the KLMR revealed that its scope is limited to catalyst projects targeting areas frequented by international tourists and private master-planned communities (Ujang et al., 2018). After the success of the Melaka Riverwalk, similar projects have not replicated in the city. Based on field surveys and observations urban design is also absent in the contemporary urban landscapes of Kota Kinabalu. In all three cities, the introduction of tactical urbanism[2] with the involvement has not yet commenced on a full city-wide scale.

The well-being city is very much determined by the level of community participation in urban planning and decision making. A questionnaire survey conducted by Kozlowski et al. in 2020 in the KLMR region among citizens above 50 years old revealed a strong nostalgia among the respondents for the 'old Kuala Lumpur' of the 1980s. An interview conducted with a non-government organisation, Coalition to Save Kuala Lumpur (CSKL) exposed that the residential community feels that basic social needs such as green open spaces, quality public areas and amenities, affordable public housing and efficient urban infrastructure have been neglected and overshadowed by exclusive international development projects. The community is frustrated with issues such as increased traffic congestions, the problem of safety and lack of community participation in urban planning and decision making. The situation in other cities in Malaysia is similar. The political culture where city mayors are not elected through the popular vote but appointed by the state or federal government only widens the gap of misunderstanding between the local authority and the urban community (Kozlowski et al., 2020).

7 Conclusions

The analysis unveiled an urgent need to address the smart city initiatives at all scale levels of intervention; the regional, city-wide district, neighbourhood and site levels in the selected cities.

Based on the outcomes deriving from the key findings a series of sustainable urban planning and management mechanisms that should be considered to fill this gap are discussed below.

A regional plan covering the entire metropolitan area and informing all local plans and strategies is a critical step forward towards a smart city. This is especially urgent in the rapid growing KLMR and greater KK region. The lack of a regional plan and a regional advisory body, comprising representatives from federal, state governments and the local councils, has a detrimental effect on future growth. The KLMR, Greater KK and Melaka are growing in an uncoordinated and rudimentary

way. Although the construction of the road network and development of the public transport system has been managed and coordinated on a regional scale by the federal and state governments, the bulk of planning and development decisions are made at the local levels. Lessons learned from urban agglomerations in Europe, Australia and North America indicate that regional plans are critical as they inform the local plans and define overarching urban planning principles for all municipalities located in a particular region.

Greater KK and Melaka must embark on constructing an efficient public transport system that will benefit both residents and visitors.

The analysis unveiled an urgent need to address the local tropical climate at all scale levels of intervention; the regional, city-wide district, neighbourhood and site levels in all three selected cities. Responding to the local climatic conditions with urban design/planning tools is important as it provides long-term strategies, guidance and directions for the region, city and the districts and neighbourhoods. Promoting tactical urbanism with the participation of the local community, including business owners is strongly recommended for all three cities. The introduction of tactical urbanism featuring low coast urban intervention and conducted with the involvement of the local community is a necessity to upgrade large chunks of decaying urban fabric.

Although the living standards of the residents increased significantly and the quality of urban services improved radically, there is a growing discontent across large sections of the community. To achieve a smart city status community participation in urban planning and urban decision making is imperative. It is critical to consider changing the political culture and introducing the election of city mayors and city representatives directly by the community. Such a move will reinforce the bond between the city leadership and the community and redirect the responsibilities of the elected politicians towards the residents and business operators. Participatory democracy is a prerequisite for achieving smart city status. A city managed together with the community will create a more attractive environment for all user groups.

Improving the smart city status with planning and design measures must be conducted through consensus, mutual understanding and cooperation among all stakeholders; including the community and the development industry. Achieving smart city status will benefit all stakeholders; including government agencies, private developers, local entrepreneurs, visitors and tourists, employees and the residents.

Notes

1. Based on interview with representative of Dewan Bandaraya Kota Kinabalu (DBKK) conducted February 2020.
2. Tactical Urbanism Tactical urbanism includes low-cost urban intervention changes to the built environment. It is intended to improve local neighbourhoods and city gathering places (Lyndon & Garcia, 2015).

References

Airlan Admin. (2014). *Messing with Melaka: The Gateway project and the destruction of a UNESCO world heritage city*. https://aliran.com/aliran-csi/aliran-csi-2014/messing-melaka-gateway-project-destruction-unesco-world-heritage-city/

Asia Development Bank. (2019). *Transforming Kota Kinabalu into a nature reserve city*. https://www.adb.org/news/videos/transforming-kota-kinabalu-nature-resort-city

Baker, J. (2008). *Crossroads: A popular history of Malaysia and Singapore.* Marshall Cavendish.

Bahrin, T. S., & Teh, T. S. (1991). Coastal land reclamation and future sea level rise implications in Malaysia. *Malaysian Journal of Tropical Geography, 22*(2), 145–161.

Cyberjaya. (2019). *History of Cyberjaya.* http://www.cyberjayamalaysia.com.my/

Dameri, R. (2013). Searching for smart city definition: A comprehensive proposal. *International Journal of Computers & Technology, 11*(5), 2544–2551.

Department of Infrastructure and Planning, Queensland Government. (2009). *Southeast Queensland Regional Plan 2009–2030.*

Department of Statistics, Malaysia. (2021). *Melaka.* https://www.dosm.gov.my/v1/index.php?r=column/cone&menu_id=YjM1UjUrVzQ1TDNIS2VXcHJZR2wzUT09

Dewan Bandaraya Kuala Lumpur (DBKL). (2012). *City plan 2020.*

DBKL. (2014). *Urban design guidelines for Kuala Lumpur city centre.*

DBKL. (2018). *Master plan for Kuala Lumpur city competitiveness.*

DBKL. (2020). *Draft Kuala Lumpur structure plan 2040: A city for all.*

Edge Prop. (2017). Kota Kinabalu Coping with Rapid Development. https://www.edgeprop.my/content/kota-kinabalu-coping-rapid-development

Emeria, M., & Toma, L., & Sanduleac, M. (2017). A smart city concept in the 21st century. *Science Direct Procedia Engineering, 181*(2017), 12–19.

Focus Architects and Urban Planners. (2006). *Sungai Melaka rehabilitation & beautification.* https://focusarchitects.com.my/project/urban-design-planning/sungai-melaka-rehabilitation-beautification.html

Friends of Earth Malaysia. (2020). *Impacts of coastal land reclamation in Malaysia.* Published by Sahabat Alam Malaysia (Friends of the Earth Malaysia).

Hamnet, S., & Forbes, D. (2011). Risks, resilience and planning in Asian cities. In S. Hamnet & D. Forbes (Eds.), *Planning Asian cities: Risks and resilience* (pp. 1–39). Routledge.

Idris, R., Masur, K., Zamani, R., & Kogid, M. (2020). *Covid-19 outbreak in Sabah: A preliminary survey on its effects on hotel industry & some key concerns during pre-movement control order period*. https://www.researchgate.net/publication/346927169_Covid-19_Outbreak_in_Sabah_A_Prelimiary_Survey_on_its_Effects_on_Hotel_Industry_Some_Key_Concerns_During_Pre-Movement_Control_Order_Period

International Urban Development Association (INTA). (2015). *Kuala Lumpur Metropolitan Malaysia.* https://inta-aivn.org/en/481-inta/activitities/exchange/roundtables/20122013-inbetween/1769-kuala-lumpur-metropolitan

Kassim, S. J., Nawami, M. N., & Majid Abdul, N. H. (2017). *The resilience of tradition: Malay illusions in contemporary architecture.* Areca Books.

King, R. (2008). *Kuala Lumpur and Putrajaya: Negotiating urban space in Malaysia.* NUS Press.

Kota Kinabalu District, Malaysia. (2019). https://www.citypopulation.de/en/malaysia/admin/sabah/1207__kota_kinabalu/

Kozlowski, M., Mehan, A., & Nawratek, K. (2020). *Kuala Lumpur: Community, infrastructure and urban inclusivity*. Routledge.

Kozlowski, M., & Mohd Yusof, Y. (2018). Revitalisation and design in the Tropics; tale of two cities—Singapore and Kuala Lumpur. In S. Huston (Ed.), *Smart urban regeneration: Visions, institutions and mechanisms for real estate.* Routledge.

Lim, Z. H. (2017). Kopitiam Ekonomi and the construction of the Malaysia neoliberal subject. In S. G. Yeoh (Ed.), *Malaysians and their identities* (pp. 63–85). Strategic Information and Research Development Centre.

Lyndon, M., & Garcia, A. (2015). *Tactical urbanism: Short-term action for long-term change*. Island Press.
MelakaGateway. (2020). *Melaka Gateway Project*. http://melakagateway.com/kaj-development-sdn-bhd/
Mohamed, J., & Rizal Razman, M. (2020). Management and initiatives towards Sustainable Costal Development in Malaysia: Experience from reclamation activities in Melaka. *Asian Journal of Environment, History and Heritage, 2*(1), 23–32.
Numbeo. (2019). *Property prices comparison in Malaysia.* https://www.numbeo.com/property-investment/compare_cities.jsp?country1=Malaysia&country2=Malaysia&city1=Kuching&city2=Kota+Kinabalu&tracking=getDispatchComparison
Pacione, M. (2005). *Urban geography: A global perspective.* Routledge, Taylor and Francis.
Perbadanan Putrajaya. (2012). *Putrajaya Green City 2025.* Perbadanan Putrajaya.
Property Hunter. (2014). *Developing Kota Kinabalu.* https://www.propertyhunter.com.my/news/2014/02/538/sabah/developing-of-kota-kinabalu
Property Hunter. (2019). *The booming of Greater Kota Kinabalu.* https://www.propertyhunter.com.my/news/2014/06/826/sabah/the-booming-of-greater-kota-kinabalu
Sabah Development Board and Investment Authority. (2019). *About us*. http://www.sedia.com.my/About_us.html
Seltzer, E. P. (2008). Regional planning and local governance: The Portland story. In T. Kidokoro, N. Harata, L. P. Subanu, J. Jenssen, A. Motte, & E. P. Seltzer (Eds.), *Sustainable city regions: Space, place and governance.* Springer.
Seng Fatt, L. (2004). *Insiders Kuala Lumpur*. Marshall Cavendish International Pty Ltd.
Shah Syed, A., Sierra-Sosa, D., Kumar, A., & Elmaghraby, A. (2021). IoT in smart cities: A survey of technologies, practices and challenges. *Smart Cities, 4*(2), 429–475. https://doi.org/10.3390/smartcities4020024
Shari, Z. (2015). *Greening tourism in Malaysia in 'Future Arc: The voice of green architecture in Asia-Pacific'* (Vol. 41, pp. 122–123).
SPAD. (2016). *Land public transport transformation in Malaysia—History, aspirations and challenges.* https://www.spad.gov.my/sites/default/files/chairman_speech-22april20161.pdf
The Edge Markets. (2021). *Melaka Gateway developer fails to challenge state's directive to halt project*. https://www.theedgemarkets.com/article/melaka-gateway-developer-fails-challenge-states-directive-halt-project
Ujang, N., Kozlowski, M., & Suhardi, M. (2018). Linking place attachment and social interaction: Towards meaningful public places. *Journal of Place Management, 11*(1), 115–129.
Urban Pathways Melaka. (2021). *Malaysia Melaka.* https://www.urban-pathways.org/melaka.html#:~:text=Melaka%20city%20has%20adopted%20the,into%20a%20low%20carbon%20city.&text=The%20GCAP%20prioritises%20GHG%20emission,projects%20that%20reduce%20energy%20consumption
Vis, L. (2007). The Colonial Legacy in Melaka. In C. Voon Fee (Ed.), *The encyclopedia of Malaysia architecture* (pp. 62–63). Archipelago Press.
World Population Review. (2018). *Kuala Lumpur population 2018*. http://worldpopulationreview.com/world-cities/kuala-lumpur-population/
Yin, R. K. (2003). *Case study research: Design and methods.* Applied social research methods (3rd ed., Vol. 5).

Marek Kozlowski, Ph.D., Senior Lecturer, Faculty of Design and Architecture, University Putra Malaysia, Malaysia. His research interests include tropical urban design, urban planning, urban regeneration, sustainable tourism planning and design.

Yusnani Mohd Yusof, Ph.D., Visiting Research Fellow and Associate Professor, Centre for Advanced Research, University Brunei Darussalam, Brunei. His research interests include tropical urban design, urban planning, urban regeneration, sustainable tourism planning and design.

A Review of Charging Schemes and Machine Learning Techniques for Intelligent Management of Electric Vehicles in Smart Grid

Saeed Mian Qaisar and Nehal Alyamani

Abstract The evolution of information and communication technology (ICT) contributes to the realization of smart cities. A smart grid is a vital element of any smart city. One of the major focuses of the upcoming smart cities is the deployment of ecofriendly intelligent systems to sustainably improve the quality of life of its habitants. To attain sustainable and green transportation, the deployment of electric vehicles (EVs) is evolving. Integration of EVs has raised various challenges such as charging infrastructures and load forecasting. Therefore, intelligent management techniques are required in this context. Various appealing tactics have been presented to solve such challenges. These are mainly based on the Internet of Things (IoT), machine learning algorithms and automata models. This chapter presents a comprehensive review of the electric vehicle charging schemes, standards, and application of various machine learning algorithms to intelligently manage the electric vehicle in the smart grid based future cities.

Keywords Smart cities · Smart grid · Electric vehicles · Dynamic charging · Data-driven techniques · Load prediction · Signal processing · Machine learning · Intelligent management systems

1 Introduction

The evolution of ICT is significantly contributing to smart cities' realization. A smart city is depicted as a framework composed of ICT for the promotion and development of sustainable practices to address the multiple challenges faced in urban settings. The intelligent network of machines and objects interconnected by the application of cloud and wireless technology forms a smart city. In real-time, the Internet of cloud-based Things manages and analyzes the data that they receive to help citizens,

S. M. Qaisar (✉) · N. Alyamani
Effat University, Jeddah, Saudi Arabia
e-mail: sqaisar@effatuniversity.edu.sa

N. Alyamani
e-mail: nalyamani@effat.edu.sa

A. Visvizi and O. Troisi (eds.), *Managing Smart Cities*,
https://doi.org/10.1007/978-3-030-93585-6_4

municipalities, and businesses make the correct decisions to achieve thebest quality of living standards (Visvizi & Lytras, 2020). The act of pairing data and devices with the physical infrastructure of a city can reduce the costs of living and provide sustainability. Connected cars can easily communicate with the charging docks for Electric Vehicles (EVs) and the parking meters. A smart city combines the physical infrastructure with ICT to facilitate mobility, improve convenience and quality of water and air and conserve energy, among other benefits. Smart buildings in a smart citywill involve sensors, actuators, central units, networks, interfaces, and intelligent metering infrastructures (Morvaj et al., 2011). Governmental agencies are trying to leverage the Low Power Wide Area (LPWAN) and cellular technologies connected to the infrastructure to improve the convenience and efficiency for both visitors and residents.

A smart grid is a concept that needs to be utilized in the energy infrastructure of smart cities to achieve the goal of minimizing energy consumption. It establishes two-way communication in all the grid nodes using an intelligent metering infrastructure (Qaisar & Alsharif, 2020). Customers can be involved in active or passive mannerisms to improve the overall efficiency of energy and grid reliability. The smart grid can also reduce environmental pollution by allowing an effective integration of renewable energy sources and EVs in the grid.

Different tangible gadgets related to the IoT connections are applied in smart cities to maximize their operations, service provision, and attract citizens, smart cities' technologies aim to make government officials interact easily with the community, improve infrastructures, and easily monitor their operations and evolution from time to time. Available information proves that smart cities are the perfect solution to the current population pressure in the developing and developed world. Such force includes but is not limited to traffic jams, housing, pollution, governance, power supply, etc. ICT is applied to improve quality in service delivery and products provided to people by the city officials, improve performance, and interact with city or urban services. As a result, this lowers the cost and use of resources by increasing close interaction between people and government. In summary, they are developed to create active and real response; they are geared to respond to challenges (Axelsson & Granath, 2018). This literature review aims to provide insights to the government and smart city developers on considering the community's wellbeing and needs while planning or making decisions.

The reduction of global CO_2 emissions and the increasing costs of carbon-based fuel products explain the requirement for environment-friendly vehicle technologies. Modern electrical vehicles (EVs) will be the opposite of conventional automobiles, and they will lead to improved air quality by decreasing greenhouse gas emissions. Successful integration of electric vehicles will address the main challenges that are faced because of using traditional vehicles. Currently, electric vehicle penetration has not portrayed a great impact on electricity demand from the power grid. As time goes by, electric vehicles will become affordable, and their usage will increase. Therefore, their impact on the smart grid energy demand and operation will be significant. There is a need for intelligent management systems to reduce the failures associated with power allocation and electricity flow across the smart grid.

2 Energy and Governance Sustainability in Smart Cities by Intelligent Information Management

Before the city and urban developers and the government decide, they should consider one of the significant issues: sustainable power production, supply, and consumption. In this endeavor, new developments such as artificial interagency and robotics computing have emerged to curb the mentioned challenges (Tai Chui et al., 2019). According to Yao et al. (2020), current research shows that cities and urban are significant power users. Therefore, this creates a significant challenge for environmental pollution and global warming. Application of new technologies in the development and management of electricity in the cities is the better option in ensuring pollution is minimized. Machine learning and IoT, for example, helps engineers understand the relationship between the behaviors and consumption of electricity. This leads to standard data for smart energy, smart grid energy interoperability, and behavioral analytics, among others that require intense considerations. Considering these current challenging sustainability issues faced by cities and urban areas, smart metering will optimize a smart grid's power efficiency. This review provides that integrated concepts and insights of engagement in smart technology may produce good results. A genetic algorithm proves carrier machine multiple kernel learning known as GA-SVM-MKL for NILM energy disintegration (Lytras et al., 2019).

The use of digital technology in cities has yielded positive results towards curbing challenges of population pressure and poor service delivery faced by the developing world. Increased finance costs related to infrastructure sustainability, significant informal economies, and different socio-political pressures make the smart cities concept lag behind. Since a smart city is a political concept on social-economic development in many developing nations? Hence, it is traced back to the early nineteenth century as the idealism of smart growth, especially in transport and planning development. Technology linked smart cities in growing economies is only attained if socio-economic, human resource, legislation, and law reforms are considered in development agendas. According to Liu (2020), this calls for technology education and embracing it by citizens and economic policy and finance embracement and will by the government.

Having understood that the smart city concept is interlinked to the socio-economic and political issues, it has become a significant research area. Education and literacy in the developing world are significant challenges towards the development of smart cities. People need to be enlightened on using new technology in the cities and urban areas; this mainly prevents any exclusion related to information illiteracy. Experts of information technology and information managers must consider the end-users of that information; otherwise, it becomes a wasted idea. Skills development is essential, perceptions, attitudes to smart services such as the use of smart cards. When these challenges are answered, functional, sustainable smart cities will succeed (Chui et al., 2018; Lytras & Visvizi, 2020; Lytras et al., 2020; Yeh, 2017).

Some challenges faced in developing smart cities and rural–urban movement related to the people's wellbeing and happiness. Security, open democracy and governance, smart education, and innovation are significant (Visvizi & Lytras, 2020). These define smart cities' fate and research in all domains, leading to in-depth solutions to the cities' challenges related to these topics. It requires all fields of studies included for better user groups and preferences. Issues of wellbeing and happiness may appear soft and straightforward, but they are critical areas of considerations while developing smart cities and smart services and technology (Wang et al., 2019).

3 Intelligent Management of Electric Vehicles in Smart Grid and Smart Cities

According to Rigas et al. (2015), approximately 23% of the CO_2 emission in the atmosphere comes from the transportation sector. This sector is ranked as the second emitter of greenhouse gasses after the industrial sector. Various steps have been introduced to address this issue of greenhouse gasses. Some of the actions taken include the 2015 "Paris Declaration on Electro-Mobility and Climate Change and Call to Action" which was adopted to meet the reduction of global warming by almost 2°. This goal of hitting a 2° reduction can be easily met if the electric vehicles sold before 2030 hits the 35% projected reduction in their current price. The target is only achievable when the price for acquiring an electric vehicle is reduced to a level with the Internal Combustion Engines (ICE) vehicles. The electric vehicle battery is costly, and it accounts for 25–50% of the vehicle's total price. Predictions depict that by 2025, electric vehicles' battery prices will decrease to approximately 225 Euros/kWh. For instance, the costs of producing Li-Ion electric vehicle batteries have reduced from 2007 to 2014 by approximately 50%. With such significant decreases, the costs for acquiring the EV will be reduced to get closer to the costs of acquiring an ICE vehicle.

The existing EVs can be categorized as battery electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs), and hybrid electric vehicles (HEVs). These categories are based on the types of energies used to drive the vehicle. BEVs utilize the energy that is stored in packs of rechargeable batteries in chemical form. PHEVs have an electric motor powered by the battery pack and an internal combustion engine (ICE) powered by fuels such as gasoline. HEVs do not need plugging into a power source for charging the battery pack. Their batteries are always charged by the inbuilt combustion engine and by regenerative braking. In BEVs, there is zero emission of greenhouse gas. In PHEVs and HEVs, the electric motor provides

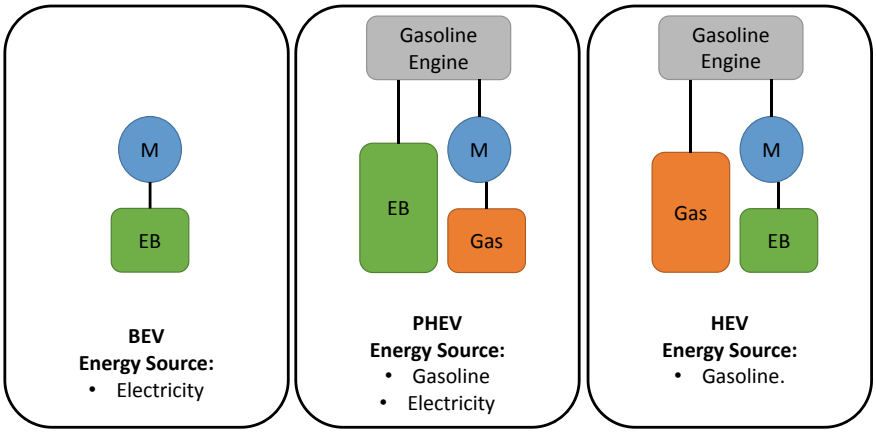

Fig. 1 Types of electric vehicles

extra power, resulting in a significantly reduced gasoline engine size, which renders a lesser greenhouse gas emission. Figure 1 depicts the various types of electric vehicles where EB is abbreviating the electric battery.

A key enhancement in smart grid improvement is the Vehicle to Grid (V2G) network. It offers new power supply and demand improvement in the smart grid network and provides mobile battery storage capacity to mitigate the impact of non-renewable energy sources (Wang et al., 2016).

In the aim of effectively integrating the EVs, the Energy Demand Management System (EDMS) is required. EDMS's objective is to optimally manage the energy available for electric vehicles recharging based on users' needs and preferences. EDMS will optimize this question by using technical and economic criteria based on the location and the charging state of EVs, user preferences, energy demand forecasts, and the state of the distribution network. One of EDMS's main advantages is the possibility to do a forecast on the EVs' demand and influence to get the best Quality of Service (QoS) levels. Figure 2 shows the EDMS concept proposed in the EVs Intelligent Charging (EVIC) (Danish et al., 2020).

For an effective realization of the EDMS, the future EVs will have an EB that will be synchronized with a reporting system. The electric cars will have an on-board unit with positioning sensors, the Global Navigation Satellite System (GNSS) receiver, Inertial Measurement Unit (IMU), and Wi-Fi wireless communication interface (Gonzalez et al., 2013). A localization unit in the On-board unit of the vehicle will calculate the EV's geographical location at any time. The car has a telephony modem that links the communication data with the cloud. In the smart city, there will be a terrestrial infrastructure for communications. This infrastructure will be in the form of a Wi-Fi roadside unit with capabilities of being deployed independently on the parking or on any other location in the city or on the stations for charging the EVs. The EDMS will be used for processing the positioning information and the charging level information sent by electric vehicles. The EDMS will have the

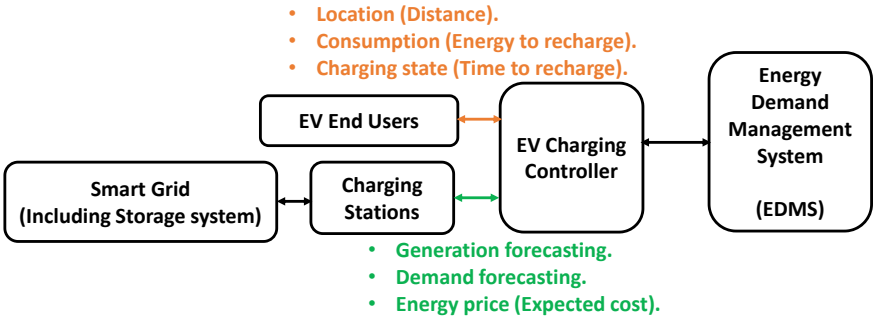

Fig. 2 The energy demand management system for EVs

capabilities to do an efficient electric power leveraging and then distribute the control based on the user's need at any convenient time. GNSS infrastructure such as Global Positioning System (GPS), Galileo, and European Geostationary Navigation Overlay Service (EGNOS) will be pivotal in launching electric vehicles in the smart grids. Wi-Fi positioning will act as an alternative for satellite positioning (Gonzalez et al., 2013). Figure 3 depicts various alternatives responsible for the effective integration of electric vehicles in smart grids and smart cities. The satellite positioning systems will ensure the effective launching of the electric vehicles in the smart city, and Wi-Fi positioning will also supplement the positioning provided by the satellite positioning systems.

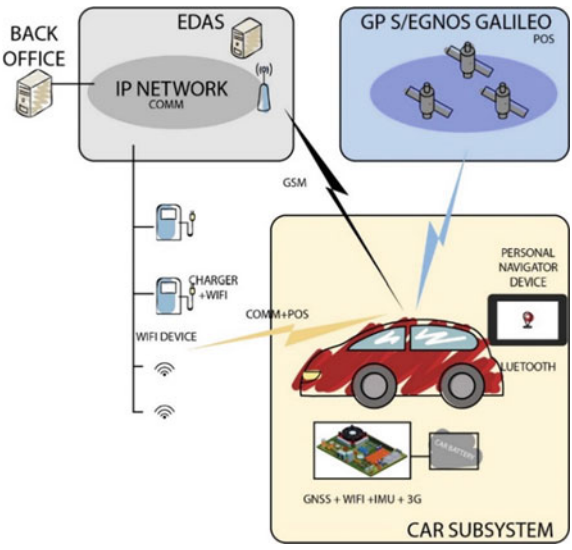

Fig. 3 EVs integration within the smart grid

3.1 Electric Vehicles Charging Schemes

According to Rigas et al. (2015), for effective deployment of EVs, smart charging infrastructure is required. The charging schemes for EVs and PHEVs are categorized as inductive and conductive. Inductive schemes mirror the wireless charging system, while the conductive scheme involves a power station that is physically connected to an electric vehicle. A conductive scheme has the DC-DC converters and the AC-DC rectifier or sometimes converters from low-frequency ac to a high-frequency AC with a Power Factor Correction (PFC).

There are the on-board and the off-board conductive chargers. In on-board chargers, the current regulators for the battery and the rectifiers are housed in the vehicle, while in the off-board chargers, they are housed outside the vehicle. The levels of power transfer can also be used to classify conductive chargers. There are various types of a charger like AC level 1 (<2 kW), AC level 2 (4–20 kW), and DC level 3 (over 20–120 kW). Table 1 depicts PHEVs and EVs models and their comparison based on one hour of charging, charging type, and the time needed for a full charge.

The Wireless Charging System (WCS) is another EVs charging approach. WCS is associated with the limitation of being utilized for cars in garages, parking lots, and traffic signals. It can only be utilized for stationary cars. Other challenges are associated with the stationary WCS are Electromagnetic Compatibility (EMC) issues, bulky structures, power transfer that is limited and short ranges. The dynamic operation mode for WCS in electric vehicles has been proposed so that improvements can be met in ranges and battery storage sizes. The dynamic operation mode would allow the electric vehicles to be charged while the vehicle is in motion. The power transfer efficiency depends on the source to receiver air-gap distances and alignment of the coil. Air-gap distance should lie between 150 and 300 mm for smaller vehicles. There are various compensation methods to reduce losses and ensure the efficiency of the system. Series combination and the parallel combination are used on both the receiving and transmitting sides.

Figure 4 is the block diagram of static WCS for EVs. For power to be transferred to the receiver coil from the transmitter coil, the grid's AC mains is converted to High Frequency (HF) alternating current through DC/AC and AC/DC converters. The receiver coil should be mounted underneath the car, and it is responsible for converting the oscillating fields of magnetic flux to high-frequency AC. Stable DC is used on the batteries, and it is arrived at after conversion of high-frequency AC. Magnetic planar ferrite plates are employed at the receiver sides and the transmitter sides to mitigate the leakage fluxes that are deemed harmful and ensure an improvement in the distribution of magnetic flux.

Inductive coupler with 97% efficiency at 8.3-kW power output and a 3 mm air-gap at 100 kHz was introduced in 1999 by Sakamoto et al. The coupler proved that the distance between receiver and Tx could make automatic charging. Wireless charging currently can only transfer power at a smaller distance (inches). Research is being carried out to increase this small distance to meters. By having smaller

Table 1 Various EVs and PHEVs models with their charging levels and battery capacities

Model	Driving distance/hour of charging	Battery energy size (kWh)	EV type	Type of charging	Full charge time (h)	Max charge rate	Study
Porsche Panamera S E-Hybrid	10	9	PHEV	Level 1/Level 2	10 h/2.5	3 kW	*PluginCars.com*
Audi A3 e-tron	11	9	PHEV	Level 1/Level 2	8 h/2.5 h	3.3 kW	*2018 Audi A3 Sportback e-tron Review & Ratings|Edmunds*
Cadillac ELR	11	16.5	PHEV	Level 1/Level2	12.5–18 h/5 h	3.3 kW	Solouk et al. (2014)
Chevy Spark EV	11	19.44	BEV	Level 1/Level 2/DC Fast charging	20 h/7 h/20 min	3.3 kW	*Chevrolet Pressroom—United States—Spark EV*
Ford C-Max Energi	11	7.6	PHEV	Level 2	2.5 h	3.3 kW	*Ford® C-Max Retired|Now What?*
Mercedes S550 Plug-inHybrid	11	8	PHEV	Level 1/Level 2	2 h/4–5 h	3.3 kW	Meiners (2014)
Toyota Prius Plug-In	11	9	PHEV	Level 1/Level 2	5.5/2	3.3 kW	The Toyota Prius Plug-in Hybrid (2010)
Mitsubishi i-MiEV	11	16	BEV	Level 2 (16 A, 10 A, 8 A) Level 3	6 h, 8 h, 10 h/30 min	3.6/2.4/1.92 kW	Hosokawa et al. (2008)
Tesla Model S	29/58/255	85	BEV	Level 1/Level 2/Supercharger		11.5 kW/17.2 kW/120 kW	*Goodwin*

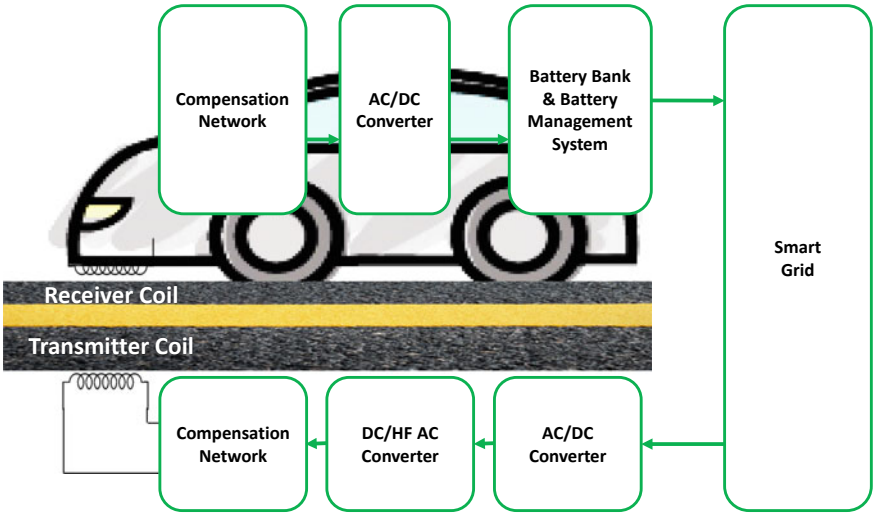

Fig. 4 Static WCS for EVs

electronics, power can be transferred to a larger distance. The Wireless Power Transmission (WPT) is classified as Coupled Magnetic Resonance (CMR) system, Permanent Magnetic Coupled (PMC), radio wave, and laser methods. Dynamic Wireless Charging (QWC) and Static Wireless Charging (SWC) are also used to classify inductive charging.

For low to medium WPT, CMR is efficient, and for power with high voltage, Inductive Power Transmission (IPT) is very effective because there is no resonant circuit. The IPT design based on a coaxial transformer with the capability of separating the primary and secondary windings has been proposed. The advantage of IPT is the absence of the male and female parts metal contacts, which avoids sparking and achieves a transfer efficiency of 85–96%. An increase in air-gap leads to a decrease in the transfer efficiency of power. A WPT with a higher power leads to the need to keep the distance between the second pad in the car and the primary pad on the ground to prevent heating due to ground clearance. The coefficients for magnetic coupling define the close coupling degree recorded between the secondary and primary winding. To transfer high power, the coupling value coefficients must be kept as high as it can be.

There is an undergoing standardization for the static wireless fast charger to apply the power that is over 20 kW. A much higher power was commercialized and developed by the OLEV and the DWC projects. The OLEV project met the high frequency, 20 kHz for 60 kW, and 83% efficiency using lateral tolerance of about 24 cm and a larger air-gap of 20 cm. Fifth-generation OLEV adopted a power station rail of S-type for the DWC characterized by a power transfer of 22 kW and an air gap of 20 cm, and a lateral tolerance of about 30 cm. The Korean railroad research has been trying to develop a dynamic WPT for a speedy train with an efficiency of 83% for

transferring an MPT of 820 kW and an air gap distance of 5 cm. Since December 2014, a dynamic WPT has operated a bus route of approximately 10 km for Malaga, bus number 16 in Spain. A research team for an integrated infrastructure solution has tried to investigate the 200 kW maximum power output, with a U-type power station rail at a frequency of 35 kHz. Figure 5 depicts the classification of contactless charging methods for EVs.

The EM fields produced by the antenna of an electric charge that is moving are under two categories: the near field or the non-radiative region and the far-field or the radiative region. When energy is constant at the transmitter (Tx) small region, we call that near field. There has to be a receiver for Tx to emit power. The near field ranges are small and dependent on the shape and size of the receiver and Tx. In the non-radiative region, there are separate magnetic and electric fields. Electrodes can thus be used during the transfer of power through the electric fields and coils for magnetic fields. The power decay factor is 1/r3 as the distance increases with r, and the energy is constant at a shorter distance between the receiver and Tx. The WPT electric field can only transmit power at a very shorter distance due to a higher power decay rate. The WPT magnetic field transfers powers at longer distances because the magnetic fields can easily penetrate furniture, people, and wall. WCS for an electric vehicle needs two factors for the increment of the air gap and efficiency. The operational frequency can be modified to make the system more efficient and compact. With the increase of the WPT frequency, there is an increase in efficiency with a power level limit. Various research entities, industries, and universities that

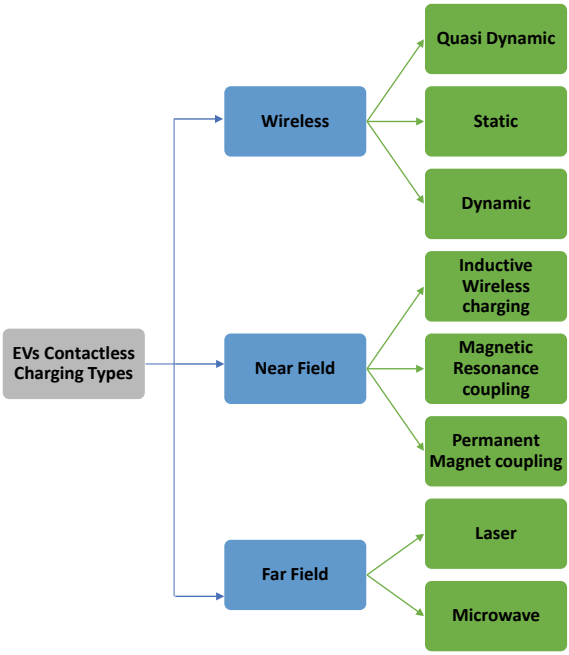

Fig. 5 Types of contactless charging methods for EVs

are researching wireless charging have achieved some solutions. In the WPT system, there is a realization of high frequency as about 1 MHz increases it. A system with a frequency between 100 and 200 kHz has been proposed. The expression derived is $T_0 = \omega M/R_0$. T_0 is the quality factor for transfer, and M is the receiver to Tx mutual inductance, and ω is the resonant frequency, and the equivalent resistance is R_0. To get the maximum efficiency, you must ensure that a large TQ is used. To maximize TQ, there is a need to maximize the driving frequency, increase the mutual inductance, and decrease the equivalent resistance. $\omega = 1/\sqrt{LC}$, is the resonant frequency with L as the inductance and C as the capacitance. To reduce the resonant frequency, we need to increase L and or increase C. If the frequency is increased to be so high, the switching problem starts during the conversion time. A coupling coefficient that is low leads to a WPT system restricting working when the frequency is high. Table 2 shows the various applications of WPT at distinct frequencies. The frequency is fixed for implementation. In the standardization case, frequencies are fixed for the system to obtain the maximum efficiency.

Efficiency standards, operating frequency, power level, EMI, safety, and testing of technology research and Electromagnetic Compatibility (EMC) are vital for the creation of a Wireless Electric Vehicle Charging Systems (WEVCSs) environment that is user friendly in nature. Society of Automotive Engineers (SAE), International Electro technical Commission (IEC), Institute of Electrical and Electronics Engineers (IEEE), and Underwriters Laboratory (UL) have researched intensively

Table 2 Applications at different frequencies

Name	Frequency	Efficiency	Distance WPT	Year	Power	Study
KAIST	20 kHz	71–85%	1–20 cm	2013	60 kW (OLEV buses)	Ko and Jang (2013)
KRRI	60 kHz	82.7A	5 cm	2012	818 kW	Kim et al. (2015)
Qualcomm Halo	20 kHz	NA	NA	2012	7 kW	Fisher et al. (2014)
Saitama University	50 kHz	94%	7 cm	2011	1.5–3.0 W	Chigira et al. (2011)
University of Auckland	85 kHz	91.3%	10 cm	2015	I kW	Kamineni et al. (2015)
ETH Zurich	1 MHz 85 kHz	96.5% 95.8%	52 mm 10–20 cm	2015	5 kW 50 kW	Bosshard and Kolar (2016), Bosshard et al. (2015)
Setsunan University	1.20–2.45 GHz	20–98%	5–25 cm	NA	NA	Horiuchi and Kawashima (2010)

Table 3 International Standards for WEVCS

Organization/Society	Relevant Standard/s	Standard definition/description	Year	Study
Society for Automobile Engineers (SAE)	J2954	Wireless power transfer for light-duty plug-in EVs and alignment methodology	2017	*J2954: Wireless Power Transfer for Light-Duty Plug-In/ Electric Vehicles and Alignment Methodology—SAE International* (no date)
Institute of Electrical and Electronics Engineers (IEEE)	P2100.1 (Joseph & Elangovan, 2018)	Wireless power and charging systems	2017	
Underwriters Laboratories Inc. (UL)	Subject 2750	Outline of investigation, for WEVCS	2017	Ahmad et al. (2018)
International Organization for Standardization (ISO)		Electrically propelled road vehicles—magnetic field WPT—safety and interoperability requirements	2017	Kim et al. (2015) 14:00–17:00 (no date) Leskarac et al. (2015)
International Electro-mechanical Commission (IEC)	61980–1 Cor.1 Ed.1.0	EV win systems Part -1: General requirements	2015	Leskarac et al. (2015)

for commercialization enabling. International Commission on Non-Ionizing Radiation Protection (ICNIRP), Federal Communications Commission (FCC), and American Association of Medical Instrumentation (AAMI) have regarded the EMC levels agreement, the Electrical and Magnetic Field (EMF) limits, and compatibility with medical monitoring devices like pacemakers. The interoperability and standardization aspects have not been developed completely due to the obstacles faced during technological deployment. Table 3 depicts the on-going and the announced updated WEVCS standards that are related globally. The international standards cover the vehicle assembly and the ground assembly, including the upgradability and modifications on the PHEVs or EVs for commercialization and research purposes. For example, SAE international announces power transfer in wireless form for electric vehicles and PHEVs with a similar operating frequency ranging between 81.39 and 90 kHz for smaller cars as depicted in Table 4. The standard includes the electromagnetic limits, minimum efficiency, power levels for the WEVCS demonstration, and experimentation purposes. The committee of SAE J2954 WPT has carried out the standardization and full vehicle tests. Additional standards will be announced in the future for a methodology of alignment, dynamic WEVCS, and power transfer that is bi-directional in nature.

Table 4 Summary of studies on the application of machine learning techniques for predicting the traveling distances of EVs

Methods	R	RMSE	MAE
GRNN (Mansour-Saatloo et al., 2020)	0.9899	1.1474	0.8199
ANN (Panahi et al., 2015)	–	1.809	–
KNN (Verma et al., 2019)	0.8928	–	–
Random forest algorithm (RFA) (Verma et al., 2019)	0.9459	–	–
Classification and regression trees (CHART) (Verma et al., 2019)	0.9186	–	–
Levenberg Marquardt (LM) (Jahangir et al., 2019)	0.8683	15.90	9.09
Rough based CEBP (R-CEBP) (Jahangir et al., 2019)	0.8969	12.56	7.84
Recurrent Rough network with (RR-LM) (Jahangir et al., 2019)	0.9588	8.10	5.48

3.2 Use of Machine Learning Techniques for the Intelligent Management of Electric Vehicles

In literature, various techniques have been devised to manage electric vehicles. These techniques can collectively or individually manage electric vehicles such as the web developed mobile applications that can give adequate information to the electric vehicles' drivers. The information that is provided by the mobile applications is based on the available slots for charging. Prototypes have also been developed to decrease the charging time for a full battery of the electric vehicle to less than an hour. The activities of electric vehicles will need to be controlled by using algorithms that have the capabilities to solve various queries involving large amounts of heterogeneous entities. These entities may be in the form of the electric vehicle owner, grid operators, profit maximization, the needed energy to charge, the owners of the charging points, and the future uncertainties such as the future energy demand and the arrival of new electric vehicles generation (Rigas et al., 2015).

Artificial intelligent approaches following electric vehicle application issues have been developed. There is energy efficiency for the electric vehicle and the maximization of the range estimation techniques. Algorithms have been developed to ensure that the electric vehicles' route follows the least cost in terms of the harvested energy during the trip, and the energy loss is greatly minimized.

An electric vehicle's route is decided by an expense limit M (Rigas et al., 2015). If the original estimate is given by e(v, m) with non-negative costs. To get the minimum battery load, we add $b_{min}(w)$ to the estimate. If the resulting value $b_{min}(v) = b_{min}(w) + \text{cost(e)}$ exceeds M, the edge is dropped because it cannot be used and thus we define a cost function as:

$$c_e^+(b_w) = \begin{cases} Cost(e) bw \leq M - cost(e) \\ \infty Otherwise \end{cases} \quad (1)$$

If the original edge, e = (v, m) has negative costs, we subtract the value of the cost from $b_{min}(w)$. We obtain $b_{min}(v)$. The cost function is given by:

$$c_e^-(b_w) = \begin{cases} -bwbw < -cost(e) \\ Cost(e)Otherwise \end{cases} \quad (2)$$

After getting the least cost for harvested energy, the electric vehicles need to be integrated into the smart grid by using various mechanisms that will mitigate issues like peaks and overloads. The devised mechanisms ensure that electric vehicles can be bidding for electricity at a market place to minimize the costs. Charging of electric vehicles' collectives and using price signals to ensure that the vehicles do not charge at locations with higher demand (Rigas et al., 2015). The vehicle landscape can be depicted by using Fig. 6.

A variety of machine learning techniques are used for EV applications. Certain frequently used methods are Decision Trees, Artificial Neural Networks (ANN), Support Vector Machines (SVM), Generalized Regression Neural Network (GRNN), and k-Nearest Neighbors (KNN). The errors of predictions are mainly computed in terms of r, MAPE, and RMSE. Here, r stands for the correlation coefficient, RMSE is the root-mean-square error, and MAPE is the mean absolute error. MAPE, RMSE, and r can be respectively computed by using Eqs. (3), (4), and (5). Where Xi is the true value, and Yi is the approximated value of the ith instance. X' is the mean of true values vector, and Y' is the mean of predicted values vector.N is the number of predicted values.

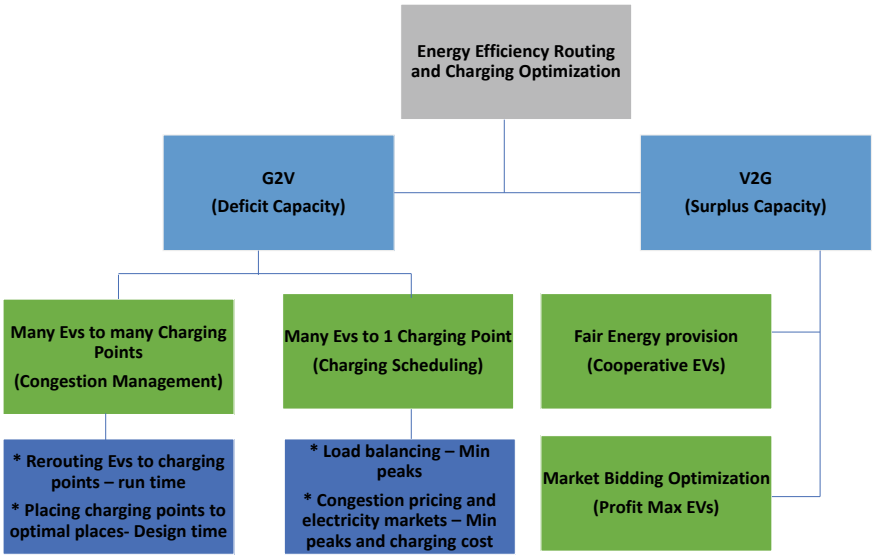

Fig. 6 Energy efficiency routing and charging optimization for EVs

$$MAPE = \sqrt{\frac{\sum_{i=1}^{N} \left(\frac{|Xi - Yi|}{Xi}\right)^{1}}{N}} \times 100\% \tag{3}$$

$$RMSE = \sqrt{\frac{\sum_{i=1}^{N} (Xi - Yi)^2}{N}} \tag{4}$$

$$r = \frac{\sum_{i=1}^{N} \left(Xi - X'\right)(Yi - Y')^{1}}{\sqrt{\sum_{i=1}^{N} (Xi - X')^{1}} \sqrt{\sum_{i=1}^{N} (Yi - Y')^2}} \tag{5}$$

For EVs integrated systems, there is the challenge of the uncertainty that is faced in EVs load profile. It is possible to forecast the EVs' load profile after ensuring a power grid optimal scheduling to avoid the higher penetration stresses. The battery capacity defines the power demanded by the EV load. The battery capacity of a Nissan Leaf is 30 kWh. That battery capacity is four times larger than the demand needed by a residential building. To forecast the load profile of EVs, various techniques have been proposed. Probabilistic-based methods is a plug-in EVs, stochastic model, to enhance the extraction of the EVs load demands based on the nonlinearity of the charging battery behavior. The Markov chain method is a Markov or hybrid grey model that is used to consider the trend of object-principle and the fluctuation that is depicted in load forecasting of EVs.

In Xydas et al. (2013), authors have presented ANN, SVM, and Decision Trees usage to predict electric vehicle load forecasting. Train dataset and test dataset are the two divisions of the initial dataset in the data configuration stage. For training the model, the training dataset is used, and also, it is also used to find the correlations that are deemed to be hidden and pattern between the target values and attribute values. The test dataset evaluates the performance of the method for data mining. The knowledge that is obtained by the training dataset is used during the evaluation processes. The train and test sequence is repeated for like 20 different parameter combinations to select the combination with the greatest degree of accuracy. The model's accuracy can be assessed using MAPE (mean absolute percentage error), RMSE, and r-correlation. The duration is taken to test, and the train was also used for performance evaluation. From the study, SVM provides the most accurate results for forecasting with a 98.09% r-correlation. SVM has a slower training process when compared to other methods. ANN had a great performance, and it did not consume much time. For the measuring of the accuracy for load forecasting, the MAPE criterion was the most appropriate standard. A value of 5% and below is the most effective. Using the RMSE index, there is strong penalization for the large absolute errors.

The EV traveling demands and behaviors can be modeled by the use of the Markov model. Queuing theory is a charging model for a single electric vehicle that has been improved for multiple electric vehicles. Origin–Destination (OD) and traffic studies have also been used to forecast electric vehicles' load profile. The correlation

of the datasets is the primary issue facing all the proposed methods. The use of machine-learning methods can solve the issue.

The variation of ANN has been proposed in the form of Nonlinear Autoregressive Exogenous (NARX) to model the EVs' driving behaviors for estimation over the long term. The household charging patterns have been analyzed by the use of a data mining approach. ANN is poor when it comes to accuracy compared to machine-learning techniques, but it can run a correlation between datasets. In Mansour-Saatloo et al. (2020), authors have used the GRNN approach to forecast the EVs' load profile. To evaluate GRNN effectiveness in predicting the traveling-distance, a comparison is made based on the obtained results from other methods. Table 4 summarizes a comparison of various studies' results in predicting the traveling distance of Evs.

4 Discussion

The trend of integrating renewable energy resources and electric vehicles in smart cities is evolving in the context of contributing to the reduction of greenhouse gas emissions. The integration of electric vehicles in the smart grid may have several approaches. However, they are mainly based on two principle architectures, namely decentralized and centralized. The centralized architecture involves an aggregator that acts as the central controller, which directs all the electric vehicle participants' decision of charging. The central architecture is grid-oriented and aims at fulfilling the power grid objectives. The decentralized architecture is user-oriented and aims to adapt according to the decisions made by users of EVs. In the decentralized architecture, the benefits are sought to be achieved according to the user's preferences.

In the central architecture, there is a need to have optimizations that are scheduled globally so that fleet of vehicles is charged based on decisions that follow a certain set objective and general constraints. The central architecture requires understanding future information such as the electricity price fluctuations, the base loads, the regulation fluctuations, and mobility-related information. The grid-oriented approach following the decentralized criteria will need updated electric vehicle information and the future information prediction based on algorithms that can shift the load and regulate the frequency so that the costs for electricity generation are minimized and the emissions of carbon are reduced significantly.

The decentralized architecture is vital because it follows the electrical vehicle owners' charging decisions given opportunities to interact with the direct management programs. It can use a common profile for electricity prices to determine the total delivered energy to the electric vehicle in real-time while minimizing the battery's degradation and cost of operation. The electric vehicle can determine its needed optimal strategies for charging based on a common profile for electricity prices by automatic ways. The electric vehicles' decisions indicate that the profile for electric costs is updated consistently, leading to a negligible price profile.

A summary of the main attributes of the centralized and decentralized architectures is presented in Fig. 7.

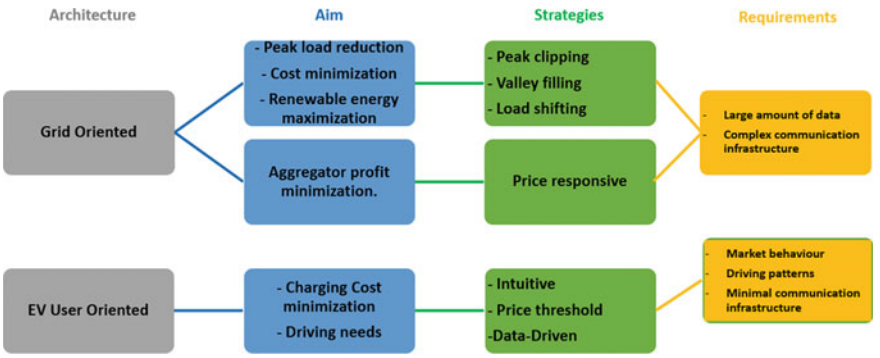

Fig. 7 Centralized and decentralized architectures for the integration of EVs in the smart grid

For the minimization of the operational and electricity, cost-effective automated decision making is required. It should be performed to bring benefits to different stakeholders like power generation entities, distribution and management enterprises, governmental institutions, and end-users. In Dinh Thai et al. (2017), authors have used cyber insurance for lower charging costs and higher discharging profiles to be achieved. The proposed cost function can consider a Cartesian product for decision making on charging, insurance availability, and coverage to determine the immediate costs. A learning algorithm is essential for learning the optimal policy for selecting decisions using a gradient that is idealized as a parameterized cost function. In Gao (2019), authors have studied the application of improved grey theory prediction model in medium-term load forecasting of EVs in the distribution network. In Lopez (2019), the author has proposed a machine learning mechanism for EVs' smart charging. In Yu et al. (2019), authors have studied the influence of EVs charging on the smart grid's load profile in the presence of renewable energy sources. They proposed that how the drawbacks can be mitigated. In Rigas et al. (2015), artificial intelligence is reported for managing the EVs in the smart grid. In Sangdehi et al. (2012), the authors have proposed a linear prediction approach for EVs' short-term demand forecasting. In Zhai et al. (2019), an agent cellular automata has presented for the dynamic prediction of EVs charging demand and traffic load variations. Authors have employed machine learning techniques in this regard.

Although smart city development is a good idea in curbing population pressures, population growth comes with population growth, especially in the developing world. It cannot be executed with a blind eye as it creates new social, political, and economic challenges such as technology discrimination and exclusion. It requires extensive research and considerations of all people, and a multidisciplinary approach is a perfect bet (Sultana et al., 2018; Visvizi et al., 2017). Study on smart cities calls for integrating complicated computational technologies for social services delivery and better understanding it by the end-users.

5 Conclusion

The evolution of ICT is significantly contributing to the realization of smart cities. A smart grid is a vital element of any smart city. To mitigate the problem of increasing global warming and greenhouse gas emissions, governmental and industrial stakeholders encourage electric vehicle usage. Integration of electric vehicles has raised various challenges in the modern smart grids. Two crucial issues are the realization of effective charging schemes and intelligent energy demand and management systems. In this framework, numerous techniques and solutions have been proposed. In this chapter, a comprehensive review of the electric vehicle charging schemes, standards, and application of various data-driven models and machine learning algorithms to efficiently integrate electric vehicles in the smart grid is presented. The modern smart grid-related energy management services and applications in the context of the predicted massive integration of electric vehicles in upcoming smart cities are also discussed.

As a result, there is a need for the stakeholders to consider the wellbeing and happiness of the communities, people's security, matters of electricity, information, service delivery, education, and other issues while making decisions about such robust infrastructure development (Wang et al., 2019). When all parties and issues are well-considered, then such development of smart cities and technology will always succeed.

While considering the technological advancements to attain sustainable solutions, confronts and prospects have been presented. The conductive and inductive EV charging methodologies are reviewed. Key studies on electric vehicles and plug-in hybrid electric vehicle models and their charging levels and battery capacities are discussed. Recent progress in stationary and dynamic wireless charging schemes are reported. Applying various frequencies in the wireless charging schemes is also reviewed with the international standards for wireless electric vehicle charging schemes. Recent machine learning approaches and automat models used for the electric vehicle integration effectiveness in the smart grid are summarized and reviewed. Modern techniques for electric vehicles' dynamic load forecasting, range prediction, and traffic impact estimation are reviewed.

The ecological, financial, and social impacts of public infrastructure effective implementation in energy consumption, longevity, and reliability must be closely assessed for prospective real-world integration of electric vehicles. The advancement of wireless power delivery strategies and protocols and vehicle-to-grid and grid-to-vehicle transmission systems are discussed and studied in the future. Another axis is the exploration of electric cars based mobile energy storage and delivery infrastructures to adapt distributed micro grids based on renewable energy.

Acknowledgements This work is funded by the Effat University, 22332, Jeddah, Saudi Arabia

References

Ahmad, A., Alam, M. S., & Chabaan, R. (2018). A comprehensive review of wireless charging technologies for electric vehicles. *IEEE Transactions on Transportation Electrification*. https://doi.org/10.1109/TTE.2017.2771619

Axelsson, K., & Granath, M. (2018). Stakeholders' stake and relation to smartness in smart city development: Insights from a Swedish city planning project. *Government Information Quarterly, 35*(4), 693–702. https://doi.org/10.1016/j.giq.2018.09.001

Bosshard, R., et al. (2015). Modeling and –Pareto optimization of inductive power transfer coils for electric vehicles. *IEEE Journal of Emerging and Selected Topics in Power Electronics, 3*, 50–64. https://doi.org/10.1109/JESTPE.2014.2311302

Bosshard, R., & Kolar, J. (2016). Multi-objective optimization of 50 kW/85 kHz IPT system for public transport. *IEEE Journal of Emerging and Selected Topics in Power Electronics, 4*, 1–1. https://doi.org/10.1109/JESTPE.2016.2598755

Chevrolet Pressroom—United States—Spark EV. (no date). *media.gm.com*. Retrieved November 2, 2020, from https://media.gm.com/media/us/en/chevrolet/vehicles/spark-ev/2016.tab1.html

Chigira, M., et al. (2011). Small-size light-weight transformer with new core structure for contactless electric vehicle power transfer system. In *2011 IEEE Energy Conversion Congress and Exposition (ECCE)*, Phoenix, AZ, USA (pp. 260–266). IEEE. https://doi.org/10.1109/ECCE.2011.6063778.

Chui, K. T., Lytras, M. D., & Visvizi, A. (2018). Energy sustainability in smart cities: Artificial intelligence, smart monitoring, and optimization of energy consumption. *Energies, 11*(11), 2869.

Danish, S. M., Zhang, K., & Jacobsen, H.-A. (2020). A blockchain-based privacy-preserving intelligent charging station selection for electric vehicles. In *2020 IEEE International Conference on Blockchain and Cryptocurrency (ICBC),* Toronto, ON, Canada (pp. 1–3). IEEE. https://doi.org/10.1109/ICBC48266.2020.9169419

Dinh Thai, H., et al. (2017). Charging and discharging of plug-in electric vehicles (PEVs) in vehicle-to-grid (V2G) systems: a cyber insurance-based model. *IEEE Access*. https://doi.org/10.1109/ACCESS.2017.2649042

Fisher, T. M., et al. (2014). Electric vehicle wireless charging technology: A state-of-the-art review of magnetic coupling systems. *Wireless Power Transfer, 1*(2), 87–96. https://doi.org/10.1017/wpt.2014.8

Ford® C-Max Retired | Now What? (no date). *Ford Motor Company*. Retrieved November 2, 2020, from https://www.ford.com/cars/c-max/2018/

Gao, F. (2019). Application of improved grey theory prediction model in medium-term load forecasting of distribution network. In *2019 Seventh International Conference on Advanced Cloud and Big Data (CBD)* (pp. 151–155). IEEE.

Global Liveable and Smart Cities Index. (no date). Retrieved December 7, 2020, from https://www.worldscientific.com/worldscibooks/10.1142/11587

Gonzalez, L., et al. (2013). EVIC (Electric vehicle intelligent charging). In *2013 World Electric Vehicle Symposium and Exhibition (EVS27)* (pp. 1–8).

Goodwin, A. (no date). *2017 BMW i3: Now available with more EV range!*, *Roadshow*. Retrieved November 2, 2020, from https://www.cnet.com/roadshow/reviews/2017-bmw-i3-preview/

Horiuchi, T., & Kawashima, K. (2010). Study on planar antennas for wireless power transmission of electric vehicles. *IEEJ Transactions on Industry Applications, 130*, 1371–1377. https://doi.org/10.1541/ieejias.130.1371

Hosokawa, T., Tanihata, K., & Miyamoto, H. (2008). Development of i-MiEV next-generation electric vehicle (second report). *Mitsubishi Motors Technical Review, 20*, 53–60.

J2954: Wireless Power Transfer for Light-Duty Plug-In/ Electric Vehicles and Alignment Methodology—SAE International. (no date). Retrieved November 2, 2020, from https://www.sae.org/standards/content/j2954_201605/

Jahangir, H., et al. (2019). Charging demand of plug-in electric vehicles: Forecasting travel behavior based on a novel rough artificial neural network approach. *Journal of Cleaner Production, 229*, 1029–1044. https://doi.org/10.1016/j.jclepro.2019.04.345

Joseph, P. K., & Elangovan, D. (2018). A review on renewable energy powered wireless power transmission techniques for light electric vehicle charging applications. *Journal of Energy Storage, 16*, 145–155.

Kamineni, A., Covic, G., & Boys, J. (2015). Analysis of co-planar intermediate coil structures in inductive power transfer systems. *IEEE Transactions on Power Electronics, 30*, 6141–6154. https://doi.org/10.1109/TPEL.2014.2378733

Kim, J., et al. (2015). Development of 1 MW inductive power transfer system for a high speed train. *IEEE Transactions on Industrial Electronics, 62*, 1–1. https://doi.org/10.1109/TIE.2015.2417122

Ko, Y. D., & Jang, Y. J. (2013). The optimal system design of the online electric vehicle utilizing wireless power transmission technology. *IEEE Transactions on Intelligent Transportation Systems, 14*, 1255–1265. https://doi.org/10.1109/TITS.2013.2259159

Lee Kuan Yew School of Public Policy. (no date). Retrieved December 7, 2020, from https://lkyspp.nus.edu.sg/

Leskarac, D., et al. (2015). PEV charging technologies and V2G on distributed systems and utility interfaces (pp. 157–221). https://doi.org/10.1049/PBPO079E_ch6

Liu, H. (2020). Smart cities: Big data prediction methods and applications. *Springer Singapore*. https://doi.org/10.1007/978-981-15-2837-8

Lopez, K. L. (2019). A machine learning approach for the smart charging of electric vehicles. Retrieved November 2, 2020, from https://corpus.ulaval.ca/jspui/handle/20.500.11794/34741

Lytras, M.D., Visvizi, A., Chopdar, P.K., Sarirete, A., Alhalabi, W. (2021) 'Information Management in Smart Cities: Turning end users' views into multi-item scale development, validation, and policy-making recommendations', International Journal of Information Management, Volume 56, February 2021, 102146. https://doi.org/10.1016/j.ijinfomgt.2020.102146

Lytras, M.D., Visvizi, A. (2021) Information management as a dual-purpose process in the smart city: Collecting, managing and utilizing information, International Journal of Information Management. https://doi.org/10.1016/j.ijinfomgt.2020.102224

Lytras, M. D., Visvizi, A., & Sarirete, A. (2019). Clustering smart city services: Perceptions, expectations, responses. *Sustainability, 11*(6), 1669. https://doi.org/10.3390/su11061669

Mansour-Saatloo, A., et al. (2020). Machine learning based pevs load extraction and analysis. *Electronics, 9*, 1150. https://doi.org/10.3390/electronics9071150

Meiners, J. (2014). *2015 Mercedes-Benz S550 plug-in hybrid*, *car and driver*. Retrieved November 2, 2020, from https://www.caranddriver.com/reviews/a15108011/2015-mercedes-benz-s550-plug-in-hybrid-first-drive-review

Morvaj, B., Lugaric, L., & Krajcar, S. (2011). Demonstrating smart buildings and smart grid features in a smart energy city. In *Proceedings of the 2011 3rd International Youth Conference on Energetics (IYCE)* (pp. 1–8).

PluginCars.com. (no date). Retrieved November 2, 2020, from https://www.plugincars.com/porsche panamera-s-e-hybrid

Panahi, D., Deilami, S., & Masoum, M. (2015). Forecasting plug-in electric vehicles load profile using artificial neural networks. https://doi.org/10.1109/AUPEC.2015.7324879

Qaisar, S. M., & Alsharif, F. (2020). Signal Piloted Processing of the Smart Meter Data for Effective Appliances Recognition. *Journal of Electrical Engineering & Technology, 15*, 2279–2285. https://doi.org/10.1007/s42835-020-00465-y

Rigas, E., Ramchurn, S., & Bassiliades, N. (2015). Managing electric vehicles in the smart grid using artificial intelligence: A survey. *IEEE Transactions on Intelligent Transportation Systems, 1*. https://doi.org/10.1109/TITS.2014.2376873

Sangdehi, M., et al. (2012). *Short term power demand forecasting in light- and heavy-duty electric vehicles through linear prediction method* (pp. 1–6). https://doi.org/10.1109/ITEC.2012.6243480

Tai Chui, H., Vasant, P., Wen Liu, R. (2019) Smart city is a safe city: information and communication technology–enhanced urban space monitoring and surveillance systems: the promise and limitations, in: Visvizi, A., Lytras, M.D. (eds) Smart Cities: Issues and Challenges, Elsevier, 2019, pp. 111–124. https://doi.org/10.1016/B978-0-12-816639-0.00007-7

Solouk, A., Shahbakhti, M., & Mahjoob, M. J. (2014). Energy management and control of a hybrid electric vehicle with an integrated low temperature combustion (LTC) engine. In *Dynamic Systems and Control Conference* (p. V002T20A005). American Society of Mechanical Engineers.

Stakeholders' stake and relation to smartness in smart city development: Insights from a Swedish city planning project—ScienceDirect. (no date). Retrieved December 7, 2020, from https://www.sciencedirect.com/science/article/pii/S0740624X17304860

Sustainability | Free Full-Text | How to Evaluate Smart Cities' Construction? A Comparison of Chinese Smart City Evaluation Methods Based on PSF. (no date). Retrieved December 7, 2020, from https://www.mdpi.com/2071-1050/10/1/37

The Toyota Prius Plug-in Hybrid. (2010). *PluginCars.com.* Retrieved November 2, 2020 from https://www.plugincars.com/toyota-prius-plugin-hybrid

Verma, A., et al. (2019). Analyzing household charging patterns of Plug-in electric vehicles (PEVs): A data mining approach. *Computers & Industrial Engineering, 128*, 964–973. https://doi.org/10.1016/j.cie.2018.07.043

Visvizi, A.; Lytras, M.D. (2020). Sustainable Smart Cities and Smart Villages Research: Rethinking Security, Safety,Well-being, and Happiness. Sustainability, 12, 215. https://doi.org/10.3390/su12010215

Visvizi, A., Mazzucelli, C. G., Lytras, M. (2017). Irregular migratory flows: Towards an ICTs' enabled integrated framework for resilient urban systems. *Journal of Science and Technology Policy Management, 8*(2): 227–242. https://doi.org/10.1108/JSTPM-05-2017-0020

Wang, D., et al. (2016). Quantifying electric vehicle battery degradation from driving vs. vehicle-to-grid services. *Journal of Power Sources, 332*, 193–203. https://doi.org/10.1016/j.jpowsour.2016.09.116

Wang, Y., et al. (2019). Smart solutions shape for sustainable low-carbon future: A review on smart cities and industrial parks in China. *Technological Forecasting and Social Change, 144*, 103–117. https://doi.org/10.1016/j.techfore.2019.04.014

Xydas, E., et al. (2013). Electric vehicle load forecasting using data mining methods. *IET Conference Publications.* https://doi.org/10.1049/cp.2013.1914

Yao, T., Huang, Z., & Zhao, W. (2020). Are smart cities more ecologically efficient? Evidence from China. *Sustainable Cities and Society, 60*, 102008. https://doi.org/10.1016/j.scs.2019.102008

Yeh, H. (2017). The effects of successful ICT-based smart city services: From citizens' perspectives. *Government Information Quarterly, 34.* https://doi.org/10.1016/j.giq.2017.05.001

Yu, D., et al. (2019). The impact of charging battery electric vehicles on the load profile in the presence of renewable energy. In *2019 IEEE Canadian Conference of Electrical and Computer Engineering (CCECE).* https://doi.org/10.1109/CCECE.2019.8861730

Zhai, Z., et al. (2019). Agent–cellular automata model for the dynamic fluctuation of EV traffic and charging demands based on machine learning algorithm. *Neural Computing and Applications, 31*(9), 4639–4652. https://doi.org/10.1007/s00521-018-3841-2

Shi, H.; Tsai, S.-B.; Lin, X.; Zhang, T. How to Evaluate Smart Cities' Construction? A Comparison of Chinese Smart City Evaluation Methods Based on PSF. Sustainability 2018, 10, 37. https://doi.org/10.3390/su10010037

Khee Giap Tan, Tao Oei Lim, Yanjiang Zhang, Isaac Tan National University of Singapore, Singapore) Default Book Series. January 2020

Visvizi, A., Assem Abdel-Razek, S.; Wosiek, R.; Malik, R. (2021) Conceptualizing Walking and Walkability in the Smart City through a Model Composite w2 Smart City Utility Index. Energies 14(23), 8193. https://doi.org/10.3390/en14238193

Saeed Mian Qaisar, Ph.D., Associate Professor, Electrical and Computer Engineering Department, Effat University, 22332, Jeddah, Saudi Arabia. His current area of research interest includes event-driven systems, signal processing, circuits and systems, machine learning, smart grid and sampling theory.

Nehal Alyamani, MSc Energy Engineering student, Effat University, 22332, Jeddah, Saudi Arabia. Her current area of research interest includes renewable energy, smart grid and machine learning.

Managing Safety and Security in the Smart City: Covid-19, Emergencies and Smart Surveillance

Orlando Troisi, Mohamad Kashef, and Anna Visvizi

Abstract The chapter examines the role and potential inherent in surveillance systems in smart cities today. The Covid-19 pandemic and the resultant restrictions to mobility, on the one hand, and the need for strengthened enforcement measures highlighted the already existing weaknesses and contingencies besetting surveillance in smart cities. The chapter makes a case that the adoption of smart city surveillance and infrastructure management systems may contribute to the improvement of safety and security in the smart city as well as to an overall enhancement of the smart city's resilience. The discussion in this chapter focuses on the complex processes of data acquisition, data sharing, and data utilization to explain in which ways they all add to smart surveillance systems that—while aware of individual freedoms and privacy issues—contribute to the process of making a smart city resilient. To showcase the applicability of these findings, a wireless mesh network (WMN) surveillance system is presented.

Keywords Smart cities · Smart surveillance systems · Wireless mesh network (WMN) · Resilience

O. Troisi (✉)
Department of Management & Innovation Systems, University of Salerno, Via Giovanni Paolo II, 132, Fisciano, Italy
e-mail: otroisi@unisa.it

M. Kashef
Effat University, Jeddah 21478, Saudi Arabia
e-mail: mkashef@effatuniversity.edu.sa

A. Visvizi
SGH Warsaw School of Economics, Institute of International Studies (ISM), Al. Niepodległości 162, 02-554 Warsaw, Poland
e-mail: avisvi@sgh.waw.pl

Effat College of Business, Effat University, Jeddah 21478, Saudi Arabia

A. Visvizi and O. Troisi (eds.), *Managing Smart Cities*,
https://doi.org/10.1007/978-3-030-93585-6_5

1 Introduction

Smart city surveillance and infrastructure management systems have been deployed around the world. Big data-based applications can detect abnormalities, provide information about emergencies, and thus improve safety and security in the smart city. A great number of users can transmit live and recorded video data across various fixed and mobile ends of the system. Secured data repositories in the service provider network ensure that event details and reports can be retrieved and shared via different wireless communication channels. Smart contracts and blockchain play a fundamental role in ensuring the integrity of the system. Notably, effective integration of these smart technologies in city services requires public and private partnerships, regulatory frameworks, government transparency regarding risks, threats and the confidentiality of users' data and state-wide alliances between universities, research centers and citizen groups. Technological spinoff products of smart solutions include, but are not limited to, utility robots, high-tech wearables and gadgets, self-driving vehicles, augmented and/or extended reality functionalities that will penetrate various social, economic, and cultural aspects. In brief, the emergence and utilization of smart city surveillance systems gave rise to an ecosystem of tools and applications that render it necessary to recognize and harness new opportunities that pave the way toward a new generation of smart surveillance systems. While the computer science community and, so, the related debate offer several groundbreaking insights into how to embrace these opportunities, this chapter offers a managerial insight into this issue. To do so, it is necessary to make a few points that will connect the smart city debate with the field of management.

Contemporary organizations, including cities, are exposed to unexpected disruptive events (Pettit et al., 2013), which may be the source of chaos and/or impenetrable complexity (Polese et al., 2018). In these circumstances, managerial risk increases. The uncertainty of the context requires that public and private sector agents remain vigilant, and thus able to face challenges and adapt to change (Chroust & Aumayr, 2017). This imperative to remain vigilant and proactive applies also to (smart) cities. In practical terms, it means that public and private sector actors must adopt systemic approaches to enable them to deal with events of rupture and disruption. Only in this way, it is possible for them not only to survive, but possibly also to thrive in a context defined by volatility and uncertainty. This observation applies also to smart cities, the functioning of which requires information sharing and collaboration (Lytras & Visvizi, 2021) among a variety of stakeholders that pursue different agendas (Kashef et al., 2021). In the context of smart cities, the imperative of surviving and thriving has been captured by the term 'resilience' (OECD, 2016a, b) and elaborated in the subsequent debate (Lengnick-Hall et al., 2011; Lorenz, 2013; Visvizi et al., 2017). "Resilient cities are those that, in view of past shocks and impending risks and threats, have the capacity to absorb, adapt, transform and/or prepare sustainable development, well-being and inclusive growth" (Visvizi et al., 2017: 229). A resilient city displays the following features (OECD, 2016a: 3–4): it is adaptive, resilient, flexible, inclusive, and integrative. Notably, advances in information and communication

technology (ICT) have created the opportunity to employ some ICT-enhanced tools, techniques, and applications to boost smart cities' resilience (Visvizi & Lytras, 2018; Pérez del Hoyo et al., 2021). Against this backdrop, the objective of this chapter is to consider the question of management of the new generation of smart city surveillance systems in view of enhancing smart cities' resilience. The remainder of this chapter is structured as follows. In the next section, surveillance systems and the caveats related to their operation, management, and functioning, including questions of civil liberties and freedoms, are discussed. Then, a functional view of smart cities' resilience is proposed. Here, smart city surveillance systems are portrayed as important enablers of resilience. In the next section, a wireless mesh network (WMN) surveillance system is developed to examine how collaboration and distributed decision making can help citizens adjust to changes and challenges triggered, for instance, by the Covid-19 pandemic. Discussion and conclusions follow.

2 Public Realm Surveillance: Issues, Management, and the Debate

Physical human presence in the public realm is typically perceived as an effective means of enhancing the sociability and safety of urban environments. Urban theorists have often underlined the need for maximizing eyes on the street through opening building windows and doors directly onto streets and public spaces to engender a sense of communal surveillance (Kashef & El Shafie, 2020). From a societal perspective, the presence of service and police personnel in city spaces used to play a critical role in infrastructure management and security operations. Due to the explosive growth of urban areas over the last several decades and the impracticality of manning and policing every street corner, the use of video surveillance (closed-circuit television: CCTV) has become prevalent in cities around the world. The visibility of public surveillance devices, according to criminal behavior studies, contributes to the notion of "situational crime prevention", as it heightens the perceived risk of arrest by a wide range of would-be offenders (Clarke & Homel, 1997). CCTV in its simplest forms not only augments the law enforcement ability to detect and apprehend criminals, but also enhances city management operations related to public transportation, city roads, airports, water supply networks and various infrastructure components. The effectiveness of CCTV in crime detection and infrastructure surveillance varies according to the distance between fixed-location cameras and potential crime scenes or the extent and magnitude of infrastructure problems. From a different perspective, its efficiency depends on the vigilance of human operators to detect system irregularities or suspicious behaviors and communicate or deploy actionable responses (Cameron et al., 2008). The extensive use of video surveillance in cities today demands constant observation and sustained levels of human concentration. Information overload, distractions, and fatigue hinder the effectiveness of such systems (Knight, 2008). Automating all or part of this process may improve

detection and deployment of the resources needed. This section explores the features of contemporary smart surveillance systems and examines a series of integrated technologies that can aid in monitoring, access control, intrusion detection, and analysis as well as decision making and service management procedures.

2.1 Conventional Versus Smart Surveillance Systems

Security and emergency operations in most cities today still rely on disparate communication networks that include landline, cellular and mobile radio networks. During emergencies, these networks become overloaded and, therefore, unable to provide adequate services. Physical infrastructural components can, especially, be compromised by natural or man-made events. Bandwidth and overall operability of conventional networks may not be sufficient to process intensive multi-media applications such as high-resolution video sharing among security and recovery personnel. Automation and integration of auxiliary devices with CCTV would create smarter surveillance and more effective city management operations. In other words, smart surveillance systems should have the capacity to aggregate and transmit live and recorded video streams from multiple sources in and outside buildings as well as onboard vehicle cameras. In this way, they would help synchronize law enforcement/emergency management decisions in command centers and would improve the preparedness of first responders in problem locations.

Smart surveillance systems include three critical components, i.e. (i) sensors, nodes and transmitters that deliver video and data from node to node with seamless roaming at high speeds; (ii) video analytics servers that automate the process of identifying the type of emergency, analyze situational characteristics, and provide this information to first responders who could effectively identify and deploy resources required to deal with crimes and/or emergencies; (iii) WMNs that ensure failsafe connectivity, adaptability and incremental buildup of system components and users as needs arise. Smart surveillance systems thus configured provide effective data aggregation, advanced data analytics, and seamless transmission across wired and wireless channels.

Data aggregation refers to the system ability to receive live and recorded video streams from multiple sources, which may originate from either fixed locations or onboard vehicle cameras. The objective is to enhance situational awareness, and synchronize service agencies and law enforcement decisions in different command centers. Analytics servers use artificial intelligence (AI) capabilities to overlay livestreamed and stored data, identify the nature of incidents, and interpret findings into functional reports and actionable responses. The entire process is facilitated by wireless mesh technologies that effectively stream data signals between sensors, analytics terminals, and first responders (Pavon et al., 2007). Various cities around the world have established the infrastructure, gradually adding the building blocks of smart surveillance networks. For instance, the city of Nice (France) has pioneered a smart parking pilot with a four-layer architecture. The first consists of sensors

and networked devices; the second layer includes data receptors and processors distributed at different points across the city; the third accommodates central data repositories and analytics; the fourth layer provides the WMN that streams all kinds of data across the entire system (Mitchell et al., 2013; Valera & Velastin, 2005). Thus, the possibility of integrating, collecting and computing data from different sources can help to intensify the communication and the interactions within the city and between the city and external systems, by enhancing the touchpoints with internal and external stakeholders and strengthening the timeliness and transparency of information.

2.2 Multi-sensor Mobile Surveillance

Not to be confused with front-end moving cameras and monitors, multi-sensor mobile surveillance systems (VSS) denote a host of seamlessly integrated hardware instruments and software platforms. VSS can receive, process, and transmit massive amounts of audio and video streams as well as environmental information, collected and tracked over large-scale urban areas. The hardware modules include audio devices, cameras, scanners, and environmental sensors capable of analyzing and interpreting a wide array of scenes, gases, smells, fumes, etc. The analytics software coordinates the video/audio streams and sensory data and generates aggregated situational awareness reports to be conveyed via real-time multichannel communication networks to responsible agents (law enforcement personnel or responsible officials). The receiving ends of such reports include fixed monitoring stations in offices or other mobile communication devices in the field (laptops, phones, and other digital transmitters). The aggregated reports are shared with various nodes and personnel over multilayered wireless networks. Agents in such networks contribute in real time according to their respective responsibilities in the assessment of appropriate responses and the deployment of resources needed for tackling emergencies or infrastructure maintenance problems (Murakami et al., 2017; Raty, 2007; Roger, 2017).

The creation of an integrated network of sensors, devices and platforms for real-time surveillance can help smart cities synchronize the decision making of the different institutional, public, and private sector actors for a timely and more effective management of emergencies. The multi-sensor mobile surveillance system does not only contribute to sharing information in real time but can foster the detection of emergencies and the identification of the resources and actions needed to tackle the potential problems. This system can provide smart cities with relevant implications for the management of Covid-19 due to the capability of monitoring the spread of infections, tracking the effectiveness of healthcare policies, and improving the ability to be resilient and prepared for future emergencies.

2.3 AI, Big Data/Video Analytics and the Question of Managing Risks and Threats in the Smart City

Using the logic and decision-making algorithms associated with AI (cf. Visvizi, 2022), the video/data analytics modules synthesize information from multiple sources to provide integrated evaluative reports. The latter reports might incorporate assessments of unfolding events in the field and the resources required to mitigate either natural or man-made adversities. The central servers that perform video/data analytics are equipped with AI-based algorithms that analyze massive amounts of video data, environmental information collected from multiple sources and real-world human reports. This means that emergencies, disasters, or criminal activities can be tracked and analyzed in real time to inform command centers and first responders about unfolding events, appropriate responses and required resources.

The implementation of an integrated network of technologies for smart surveillance can redefine human–computer interactions in smart cities by enhancing users' decision making, thus facilitating cities' authorities to predict and preempt nascent risks, to address threats and hence to survive crises (Visvizi et al., 2017). Distributed decision making and bottom-up collaboration among users can lead to the development of innovative solutions in the city (Ciasullo et al., 2020; Polese et al., 2021). In turn, a data-driven approach can foster the collection and monitoring of data and the transparent sharing of information with citizens who, in this way, become active participants in the decision-making process (Troisi et al., 2020).

Regazzoni et al. (2010) identified three overlapping technology investigative stages in video/data analytics. The first is concerned with visual/acoustic signal modeling, which implies tracking, classifying, and integrating a multitude of graphic scenes and audible sounds from the field. Research under development in this area focuses on bridging the gap between video signal colors/luminance/compositions and digital algorithms that relate signal components to real events such as accidents, fire, flood, potential pandemic clusters, security breaches, terrorism, crime, etc. The second stage in the development of analytics technology aims to fuse video signals with data from environmental sensors and situational characteristics reported by humans in the field. The embedded intelligence capacity in the analytics software creates complex algorithms that interpret data from heterogenous sources and produce comprehensive situational reports. Cutting-edge, top-performing hardware and network design represent the third stage and backbone of analytics technology.

The seamless integration of surveillance cameras/sensors, software modules and hardware components is significant for the accuracy and credibility of video/data interpretive analytics. Applications of video/data analytics include but are not limited to congestion detection, object tracking, counter-flow signaling, facial and voice recognition, heat and smoke sensing, weapons and gunpowder surveillance, criminal activity identification, etc. The congestion application is very useful in cities, particularly during pandemic outbreaks, irregularities in public spaces, civic facilities, airports, traffic arteries, shopping malls and sports events. Based on predetermined density and related variable settings, the surveillance system triggers alarms and

provides first responders with real-time analytics of unfolding situations. The counterflow feature allows identification of objects, vehicles or persons moving against the predetermined flow directions in contexts such as airports, borders, custom facilities, tunnels, streets etc. For instance, the application of the counterflow feature proved very effective in theft detection in museum facilities and art galleries. Coordinates and secure area perimeters of valuable items are digitized into the system that triggers alarms once predetermined virtual zones are breached, environmental attributes changed, or positions shifted.

Object tracking and facial/voice recognition applications multiply the capacity of security personnel in pursuing offenders and suspicious objects, especially in areas such as airports, railway terminals and subway tunnels. They provide real-time information and whereabouts to command centers and enforcement officers in direct pursuit, thereby eliminating the need for a large number of operators and increasing the effectiveness of security operations (Freschi, 2009; O'Mara, 2009). Scalable video coding (SVC), a significant development in video/data transmission, entails the encoding of video into a scalable bitstream that reduces resolution, thereby allowing transmission over limited bandwidth conditions and reception by lower-capability terminals. The use of base layer and several enhancement layers in SVCs can automatically adjust the resolution to match the transmission nodes, lines and receiving ends (Ye et al., 2013).

The creation of multi-level technological networks for surveillance can enhance the dialogue between public actors and foster the attainment of consensus on social issues, build commitment, share the management of urban planning, empower individuals to address problems and set priorities. In this way, through interactions and negotiations, each actor in the system can share personal viewpoints, make more informed judgments and commit to public decisions by co-creating the development of mutual learning in the city.

3 A Functional View of Smart Cities' Resilience

Policies have been implemented in contemporary cities all over the world to manage limitations revealed by the pandemic and aimed at containing and mitigating disruption by pursuing innovation and resilience. Governments are employing digital transformation as a key lever for challenging Covid-19 and for developing urban growth and resilience (ABI, 2021). The pandemic has accelerated the smart transformation of cities. That is, cities have been forced to build the capacity to deal with emergency situations proactively and effectively (Lengnick-Hall et al., 2011; Lorenz, 2013). Prior to the Covid-19 pandemic, resilience was already defined as one of the key indicators of cities' performance in the United Nations (UN) Sustainable Development Goals (SDGs). Specifically, SDG11 entails the imperative of making cities safe, inclusive, resilient, and sustainable (Visvizi & Pérez del Hoyo, 2021). Data-driven cities may develop an integrated infrastructure of technologies and data analysis and

analytics not only to tackle the one-off crises but also to build long-term resilience to deal with future threats (Sharifi et al., 2021).

In this renewed technological ecosystem, smart city surveillance systems are portrayed as important enablers of resilience. In fact, different types of systems (drones, real-time dashboards, autonomous freights, and digital twins) have been introduced to improve surveillance during the pandemic (Umair et al., 2021). The design and functioning of smart surveillance systems have been reframed during the pandemic through the introduction of new instruments and command centers for security purposes and for the tracing and tracking of infected individuals. These systems contribute to facilitating surveillance and real-time monitoring of the shifting urban dynamics by proposing flexible, real-time and appropriate measures in response to the changing conditions of the context (Muse et al., 2020). Hence, the new smart city infrastructure for surveillance can strengthen the ability to manage disruption, to react not only to the current crisis but also to predict future unexpected events. Advanced surveillance methods can simplify the faster implementation of preventive measures by allowing contactless service provision. Moreover, tracing and tracking systems can help authorities and citizens comply with social distancing through the transparent communication of information about the state of the pandemic that increases citizens' risk awareness and avoids the risk of misinformation.

Finally, it can be noted that the pandemic has highlighted smart city potential by offering unprecedented opportunities for implementing innovative smart solutions. The ability to pursue innovation constantly can contribute to the development of resilience and to the continuous readaptation of communities by prompting transformative solutions that offer multiple social and economic co-benefits. Therefore, detecting technological changes introduced by Covid-19 in contemporary surveillance systems allows identification of the enablers for the management of emergency and, thus, for the attainment of resilience. The adoption of new and improved smart technologies to implement health restrictions enables the creation of new knowledge, new communication modes, and, eventually, innovation (Azoulay & Jones, 2020) and sustainability, which increase, in turn, safety, inclusion and resilience (Lytras & Visvizi, 2018; Polese et al., 2020).

4 Wireless Mesh Network (WMN)

WMNs allow two-way transmission between many nodes (stationary or mobile) and ad hoc devices across a topological mesh cloud structure. Using a system of routers and gateways, the mesh cloud can connect a broad array of fixed and portable stations such as desktops, laptops, handheld devices, and data/video sensors. WMNs create a broadband mesh cloud that facilitates wireless connectivity over multiple networks that may not only incorporate worldwide web and cellular but also a wide range of radio frequency-based instruments (Redwan & Kim, 2008). User nodes in some WMNs, act as both hosts and routers, which create a mesh network with extraordinary capacity and resilience. Software architectures are rapidly evolving and

allow unlimited numbers of users to cross communicate over wireless mesh networks without notable deterioration in efficiency or time lags. Further developments in software configurations will transform the users' devices on the network from being resource consumers to resource creators; as more nodes and clients plug into the network, the WMNs reliability, coverage, and bandwidth increase.

The signals of devices in the same coverage area can be detected and automatically incorporated into the wireless mesh, thus continuously and incrementally building up the network connectivity and capacity. Data bounces from one device or node to another until it docks into a destination node. The network topological structure is self-organizing and adapts to such ad hoc increments of client nodes and devices. By integrating cellular and web technologies, WMNs can potentially interlink a broad spectrum of fixed and roaming nodes across multiscale platforms within and outside buildings, neighborhoods, and cities (Yi et al., 2009; Akyildiz et al., 2005). Their versatility and interoperability with existing technology infrastructure resources (satellite connections, radiofrequency towers, cables, etc.) allows them to be employed in surveillance and disaster mitigation and pandemic control programs (Jun & Sichitiu, 2003; Seth et al., 2010; Portmann & Pirzada, 2008).

Three types of mesh architecture can be identified: infrastructure, client, and hybrid. The infrastructure configuration is shaped by passive client nodes that connect to mesh routers and communicate via ethernet ports. Mesh routers and conventional user nodes such as phones, computers, handhelds, and other portable devices operate under matching radiofrequency range. Some networks employ a base server station that mediate between the mesh routers and dissimilar radio frequencies (Parvin, 2019). The second WMN architecture is composed of peer-to-peer connected user nodes. In this case, the mesh clients themselves act as both hosts and transmitters with no dedicated routers that control the process of data reception and transfer between the network nodes. The hybrid WMN architecture provides a crossover between infrastructure and client configurations. Mesh clients not only receive and transmit signals, but also form the infrastructure that supports connectivity between multiple networks, platforms and devices (Parvin, 2019). This means that smaller networks incrementally bring themselves together into a larger network with routing functions and data transfer capacity across other networks and so on and so forth. As an example of such nested, built-up large mesh networks, the communication nodes inside command-and-control centers form an internal network that receive/transfer data packets locally but connect externally with field operators and first responders who form external networks of portable and handheld devices. As WMNs research advances, other related developments are needed in cryptosystems and security parameters that resolve confidentiality and privacy issues in smart surveillance systems (Cilfone et al., 2019).

5 The Co-development of Resilience in Smart Cities Through Integrated Smart Surveillance Systems

Smart technology has penetrated all facets of human life and will certainly continue to transform cities. The integrated approach adopted in this research underscores the significant role of smart technology in enhancing safety, inclusivity and resilience of cities. It considers two highly interlinked levels of smart system configuration: (i) the digital protocols and infrastructure modules that seamlessly connect a large number of agents across vast urban territories. These include WMNs and a complex surveillance sensory capacity; (ii) the assessment of a wide variety of emergency situations (natural or manmade), such as COVID pandemic, and modeling of technology users' interactions through bottom-up co-development of smart, resilient solutions. The integrated digital protocols and infrastructure modules encompass real-time assessment, access control, detection, and notification instruments. Stationary and mobile surveillance cameras and sensors could be integrated into seamlessly networked systems that permit wireless real-time tracking, multidirectional communication, big data analytics, and automated response capabilities.

Wireless mesh technologies and artificial intelligence systems facilitate the integration of a host of applications and tools such as Internet of Things (IoT), Software-Defined-Networks (SDN), mobile devices, and cloud computing services. They can boost the system capacity to process data and video from a variety of surveillance instruments across vast areas of the city. Smart recognition and tracking of humans, objects, cars, etc. allows the analytics servers to create event profiles and predict trajectory of unfolding situations. First responders can be provided with real-time information and automated intelligent reports that identify needed human resources and logistics. The deployment of smart surveillance systems can enhance decision-making process and cooperation amongst a variety of stakeholders, institutions, and citizens (Kashef et al., 2021).

Wireless technologies permit an incremental, ad-hoc buildup of an integrated system of routers and gateways that generate broadband mesh cloud with connective versatility across multiple networks, such as the worldwide web, and cellular and other radio frequency-based devices. The accumulation of smart technology resources provides tremendous potential for live-streaming, analyzing, synthesizing, and exchanging of information and summative analytical reports across command centers, institutions, citizens, and first responders. Secured data storage and processing repositories in the service provider networks ensure that unfolding events and situational reports can be retrieved and shared via different wireless communication channels. The level of engagement amongst citizens, public, and private organizations is heightened due to the constant communication and transparency in the decision-making process. Smart wireless technologies can provide richer participatory platforms that engage people in the public space and the dynamics of urban governance (Kashef, 2021). In this way, not only can users' and citizens' behavior be monitored but people's attitude toward technology, changes and the entire city and their intention and willingness to use technology and to comply with

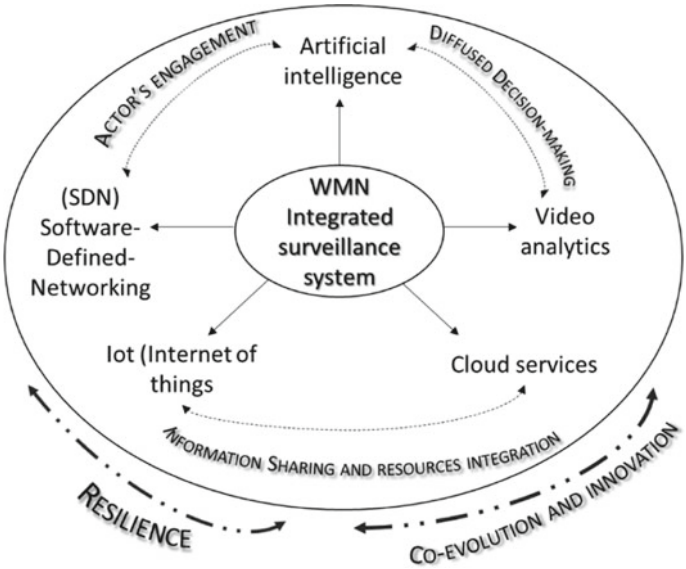

Fig. 1 An integrated model for WMN (Authors' elaboration)

the governmental guidelines dictated by the pandemic can be observed (Troisi et al., 2022).

The integration of technology resources, information sharing, and actors' engagement in the decision-making process energizes individual and institutional creative capacity (Vargo & Lusch, 2016). It generates a proactive culture that constantly seeks positive social changes and mitigate against the health repercussions of pandemics. Smart surveillance systems as previously outlined allows a better understanding of enablers for the management of emergencies and the attainment of resilience. Continuous innovation and active participation amongst community stakeholders drives social change and lies at the core of resilient cities. By harnessing cutting-edge technological resources and activating citizens' engagement, cities can rise to environmental challenges and contribute to societal progress (Troisi et al., 2021) (Fig. 1).

6 Concluding Remarks

The economic, relational, and social transformations determined by the resolution of the Covid-19 pandemic can reshape the nature of interactions between actors (citizens, public, private, and non-profit organizations, etc.). As discussed in the theoretical overview, technology can be considered as one of the key enablers for emergency management and for the attainment of resilience. The introduction of

a functional view of smart cities' resilience can help managers and urban policy-makers identify and renew old strategies and practices, by redesigning urban space and increasing efficiency and effectiveness through the implementation of flexible technological networks that can manage unpredictable phenomena and disrupting events.

The adoption of an integrated WMN for smart surveillance can contribute not only to facilitating real-time communication, enhancing data safety and engaging actors in decision-making but can also enable the constant redefinition of the connections between users and technology to improve systems' well-being and gain, over time, innovation and, thus, resilience. Integrated smart surveillance systems promise a better alternative to conventional communication technologies in use today; they could potentially disrupt the means and methods of managing city infrastructure, public health services and security protocols, by encouraging smart cities to embrace a resilient attitude toward contextual challenges.

The wireless mesh network (WMN) surveillance system proposed in paragraph 5 can foster the identification of the drivers for resilience, by increasing the knowledge on this subject and permitting urban policy-makers and decision-makers to understand the most proper strategies to be applied for the enhancement of interactions between actors and technology, the simplification of communication flows and the timeliness of decisions. The integrated system is composed of: (i) a network of multi-sensor and surveillance hardware based on AI analytics that collects data from video cameras and sensors and send it to command centers; (ii) a central server stations that permits to perform high-level data analysis and aggregation from diverse sources and locations; (iii) the WMNs that boost information flows and enhance communication between policy-makers, decision-makers, users and citizens. In this way, the WMN surveillance systems can share data in real time across hundreds of thousands of connected devices, which will enable smart city/IoT applications in high-density built environments. In this way, users and providers' access to data is improved and unexpected events can be managed efficiently and can be anticipated. Moreover, the integrated WMN system can help both policy-makers and citizens detect abnormalities and gain information about emergencies by improving safety and security in the smart city. The possibility to share live video stream can help monitor, detect and track events by trying not only to mitigate the potential negative impact of natural disasters and disruptions but also to help cities learn how to predict contextual turbulences.

An integrated set of platforms accessible to each stakeholder in the city can improve infrastructure management and maintenance operations, traffic control systems, public health protection programs, but can also raise security, citizens' quality of life and sustainability. Hence, the model proposed shows implications not only for operation, management, and functioning, but also for the potential resolution of social challenges, such as democratization of technologies, access to resources, questions of civil liberties and freedoms.

Then, the study advances: (1) the proposition of a WMN integrated systems for surveillance that can help institutions and citizens comply with social distancing through transparent communication and real time information about the state of the pandemic to increase citizens' risk awareness and avoid the risk of misinformation.

(2) the redefinition of smart surveillance systems as drivers for resilience that can contribute to turn crisis into opportunities for implementing innovative smart solutions through the proper exploitation of smart city potential. Thus, the investigation of how new technologies for smart surveillance can increase citizen's collaboration and distributed decision making can help managers understand how to challenge social and economic crisis such as Covid-19 pandemic and to pursue continuous growth by developing a resilient attitude that can develop a constant search for improvement and the incessant redefinition of technological ecosystem to address the changing contextual needs.

Acknowledgements Research reported in this chapter has been conducted in partial implementation of the National Science Center, Poland, Grant Number 2020/39/B/HS4/00579, titled: Smart cities: Modelling, Indexing and Querying Smart City Competitiveness.

References

ABI. (2021). *Smart cities and smart spaces quarterly update*. ABI Research. https://www.abiresearch.com/marketresearch/product/7778264-smart-cities-and-smart-spaces-quarterly-up/

ADT Video Surveillance Solutions. (2010). *State and Municipal Governments and Educational Institutions* (www.ADT.com)

Akyildiz, I. F., Wang, X., & Wang, W. (2005). Wireless mesh networks: A survey. *Computer Networks, 47*(4), 445–487.

Avigilon Appearance Search Technology 2020. https://www.avigilon.com/products/ai-video-analytics/appearance-search.

Azoulay, P., & Jones, B. (2020). Beat COVID-19 through innovation. *Science, 368*(6491), 553. https://doi.org/10.1126/science.abc5792

Brico Technologies, Inc. (2020). *Motorola two way radio & wireless solutions dealer Elmira.* Wellsville New York. https://www.bricotech.com/moto_wi4/wireless_video.htm

Cameron, A., Kolodinski, E., May, H., & Williams, N. (2008). *Measuring the effects of video surveillance on crime in Los Angeles, prepared for the California Research Bureau.*

Chroust, G., & Aumayr, G. (2017). Resilience 2.0: Computer-aided disaster management. *Journal of Systems Science and Systems Engineering, 26*(3), 321–335.

Ciasullo, M. V., Troisi, O., Grimaldi, M., & Leone, D. (2020). Multi-level governance for sustainable innovation in smart communities: An ecosystems approach. *International Entrepreneurship and Management Journal, 16*(4), 1167–1195.

Cilfone, A., Davoli, L., Belli, L., & Ferrari, G. (2019). Wireless mesh networking: An IoT-oriented perspective survey on relevant technologies internet of things (IoT) lab. *Future Internet, 11*, 99. https://doi.org/10.3390/fi11040099. www.mdpi.com/journal/futureinternet

Clarke, R., & Homel, R. (1997). A revised classification of situational crime prevention techniques. In S. P. Lab (Eds.), *Crime prevention at a crossroads.* Cincinnati, OH, Anderson.

Freschi, C. (2009). *Tracking video analytics software solutions.* SECURITY, November 2009. www.securitymagazine.com

Hp & Intel. *Video surveillance solution by HP and Intel: A New revenue source for both broadband and mobile technology providers 2009.* Video Surveillance Solution, October 2009, www.hpintelco.net

Jun, J., & Sichitiu, M. L. (2003). The nominal capacity of wireless mesh networks. *Wireless Communications IEEE, 10*(5), 8–14.

Kashef, M., & El Shafie, M. (2020). A multifaceted perspective on North American Urban Development. *Frontiers of Architectural Research, Elsevier, 9*(2), 467–483.
Kashef, M. (2021). Energizing street life of urban neighborhoods: Qualitative narratives versus quantitative metrics. *Theoretical and Empirical Researches in Urban Management, 16*(4), 77–95.
Kashef, M., Visvisi, A., & Troisi, O. (2021). Smart city as a smart service system: Human computer interaction and smart city surveillance systems. *Computers in Human Behavior*, June 2021
Knight, H. (2008). Crime cameras not capturing many crimes. *San Francisco Chronicle.*
Lengnick-Hall, C. A., Beck, T. E., & Lengnick-Hall, M. L. (2011). Developing a capacity for organizational resilience through strategic human resource management. *Human Resource Management Review, 21*(3), 243–255.
Lorenz, D. F. (2013). The diversity of resilience: Contributions from a social science perspective. *Natural Hazards, 67*(1), 7–24.
Lytras, M. D., & Visvizi, A. (2018). Who uses smart city services and what to make of it: Toward interdisciplinary smart cities research. *Sustainability, 2018*(10), 1998. https://doi.org/10.3390/su10061998
Lytras, M. D., & Visvizi, A. (2021). Information management as a dual-purpose process in the smart city: Collecting, managing and utilizing information. *International Journal of Information Management*. https://doi.org/10.1016/j.ijinfomgt.2020.102224
Mitchell, S., Villa, N., Stewart, M., & Anne, L. W. (2013). The internet of everything for cities connecting people, process, data, and things to improve the livability of cities and communities. *Cisco.* www.sisco.com
Motorola Inc. (2020). *Mission critical data, mobile mesh networking in Ripon, California.*
Motorola Wireless Broadband: Video Surveillance Solutions. (2008). *Motorola Inc*. www.motorola.com/motowi4
Murakami, T., Qingzhu, D., Watanabe, Y., & Hiroike, A. (2017). Video analytics technology for disaster management and security solutions, disaster management and security solutions for a safe and secure way of life. *Hitachi Review, 66*(7), 766–767.
Muse, L. P., Martins, P. R., Hojda, A., Abreu, P. A. D., & Almeida, P. C. D. (2020). The role of Urban Control and Command Centers in the face of COVID-19: The case of COR in Rio de Janeiro, Brazil. In *IEEE International Smart Cities Conference.*
O'Mara, L. D. (2009). Bringing credibility to video analytics: Overhype or unrealistic expectations? Perhaps a little bit of both. *Security Dealer and Integrator*, *31*(9), 54–57. www.securityinfowatch.com (Fort Atkinson, September 2009).
OECD. (2016a). Policy highlights of the OECD report (preliminary version). In *Resilient Cities.* OECD Publishing, Paris.
OECD. (2016b). How resilience is measured. In *Resilient cities.* OECD Publishing, Paris. Retrieved May 1, 2017, from www.oecd.org/regional/regional-policy/resilient-cities.htm
Parvin, J. R. (2019). *An overview of wireless mesh networks.* https://doi.org/10.5772/intechopen.83414
Pavon, J., Sanz, G. J., Caballero, A. F., & Valencia, J. J. (2007). Development of intelligent multisensor surveillance systems with agents. *Robotics and Autonomous Systems, 55*, 892–903.
Pérez del Hoyo, R., Visvizi, A., & Mora, H. (2021). Inclusiveness, safety, resilience & sustainability in the smart city context. In A. Visvizi & R. Perez del Hoyo (Eds.), *Smart cities and the UN SDGs.* Elsevier, 9780323851510. https://www.elsevier.com/books/smart-cities-and-the-un-sdgs/visvizi/978-0-323-85151-0
Pettit, T. J., Croxton, K. L., & Fiksel, J. (2013). Ensuring supply chain resilience: development and implementation of an assessment tool. *Journal of business logistics, 34*(1), 46–76.
Polese, F., Botti, A., Grimaldi, M., Monda, A., & Vesci, M. (2018). Social innovation in smart tourism ecosystems: How technology and institutions shape sustainable value co-creation. *Sustainability, 10*(1), 140.
Polese, F., Troisi, O., Grimaldi, M., & Sirianni, C. (2020). *Conceptualizing social change, between value co-creation and ecosystems innovation* (p. 203). Festschrift für Universitätsprofessor Dr. Dr. hc Helge Löbler.

Polese, F., Troisi, O., Grimaldi, M., & Loia, F. (2021). Reinterpreting governance in smart cities: An ecosystem-based view. In *Smart Cities and the un SDGs* (pp. 71–89). Elsevier.

Portmann, M., & Pirzada, A. A. (2008). Wireless mesh networks for public safety and crisis management applications. *IEEE Internet Computing*, January/February 2008.

Raty, T. (2007). High-level architecture for a single location surveillance point. In *Proceedings of the Third International Conference on Wireless and Mobile Communications*, ICWMC.07. Guadeloupe, French Caribbean, 4.9 March, 2007.

Redwan, H., & Kim, K. H. (2008). Survey of security requirements, attacks and network integration in wireless mesh networks. In *Japan-China Workshop on Frontier of Computer Science and Technology, FCST 2008*.

Regazzoni, C. S., Cavallaro, A., Wu, Y., Konrad, J., & Hampapur, A. (2010). Video analytics for surveillance: Theory and practice [from the guest editors]. *IEEE Signal Processing Magazine, 27*(5), 16–17.

Roger, L. (2017). *Smart cities: An overview of the technology trends driving smart cities*. IEEE Smart Cities initiative. http://smartcities.ieee.org/

Seth, S., Gankotiya, A., & Jindal, A. (2010). A comparative study between wireless local area networks and wireless mesh networks. In *IEEE Computer Society, 2010 Second International Conference on Computer Engineering and Applications*.

Sharifi, A., Khavarian-Garmsir, A. R., & Kummitha, R. K. R. (2021). Contributions of smart city solutions and technologies to resilience against the COVID-19 pandemic: A literature review. *Sustainability, 13*(14), 8018.

Strix High Performance Wireless Mesh for Video Surveillance 2020. *Strix SYSTEMS*. www.strixsystems.com/cswifimeshforipivideosurveillance.aspx

Troisi, O., Maione, G., Grimaldi, M., & Loia, F. (2020). Growth hacking: Insights on data-driven decision-making from three firms. *Industrial Marketing Management, 90*, 538–557.

Troisi, O., Visvizi, A., & Grimaldi, M. (2021). The different shades of innovation emergence in smart service systems: The case of Italian cluster for aerospace technology. *Journal of Business & Industrial Marketing*. https://doi.org/10.1108/JBIM-02-2020-0091

Troisi, O., Fenza, G., Grimaldi, M., & Loia, F. (2022). Covid-19 sentiments in smart cities: The role of technology anxiety before and during the pandemic. *Computers in Human Behavior*, *126*, 106986.

Umair, M., Cheema, M. A., Cheema, O., Li, H., & Lu, H. (2021). Impact of COVID-19 on IoT adoption in healthcare, smart homes, smart buildings, smart cities, transportation and industrial IoT. *Sensors, 21*(11), 3838.

Valera, M., & Velastin, S. A. (2005) Intelligent distributed surveillance systems: A review. *IEE Proceedings-Vision, Image and Signal Processing, 152*(2), 192–204.

Vargo, S. L., & Lusch, R. F. (2016). Institutions and axioms: An extension and update of service-dominant logic. *Journal of the Academy of Marketing Science, 44*(1), 5–23.

Visvizi, A. (2022). Artificial intelligence (AI): Explaining, querying, demystifying. In A. Visvizi & M. Bodziany (Eds.), (2021) *Artificial intelligence and its contexts: Security, business and governance*. Springer. ISBN: 978-3-030-88971-5.

Visvizi, A., & Lytras, M. (2018). Rescaling and refocusing smart cities research: From mega cities to smart villages. *Journal of Science and Technology Policy Management, 9*(2), 134–145. https://doi.org/10.1108/JSTPM-02-2018-0020

Visvizi, A., & Pérez del Hoyo, R. (2021). Sustainable Development Goals (SDGs) in the smart city: A tool or an approach? (an introduction). In A. Visvizi & R. Perez del Hoyo (Eds.), *Smart cities and the UN SDGs*. Elsevier, 9780323851510. https://www.elsevier.com/books/smart-cities-and-the-un-sdgs/visvizi/978-0-323-85151-0

Visvizi, A., Mazzucelli, C. G., & Lytras, M. (2017). Irregular migratory flows: Towards an ICTs' enabled integrated framework for resilient urban systems. *Journal of Science and Technology Policy Management, 8*(2), 227–242. https://doi.org/10.1108/JSTPM-05-2017-0020

Yi, P., Tong, T., Liu, N., & Ma, J. (2009). Security in wireless mesh networks: Challenges and solutions. In *IEEE Computer Society, 2009 Sixth International Conference on Information Technology: New Generations.*

Ye, Y., Ci, S., Katsaggelos, A. K., Liu, Y., & Qian, Y. (2013). Wireless video surveillance: A survey. *IEEE Access, 1,* 646–660. https://doi.org/10.1109/ACCESS.2013.2282613

Orlando Troisi, Ph.D., Associate Professor, University of Salerno, Fisciano, Italy. His research interests include strategic management including governance and marketing; knowledge and information management.

Mohamad Kashef, Ph.D., East Carolina University, United States & Effat University, Jeddah, Saudi Arabia. His research interests include interdisciplinary theoretical and empirical considerations within architecture and urban planning with an emphasis on sustainable and smart built environments.

Anna Visvizi, Ph.D. (dr hab.), Institute of International Studies (ISM), SGH Warsaw School of Economics, Warsaw, Poland & Effat College of Business, Effat University, Jeddah, Saudi Arabia. Her research interests include issues unfolding at the intersection of politics, economics and ICT, which translates in her research on smart cities and applied aspects of ICT.

Smart Sport Arenas Make Cities Smarter

Alessandro Baroncelli and Massimo Ruberti

Abstract Cities are home to more than half of the world's population, and urbanization is expected to further increase. They face increasing environmental pressures and infrastructure needs—and growing demands from residents to deliver a better quality of life and to do so at a sustainable cost. Smart technologies can enable all urban infrastructures thus helping cities meeting these challenges. This chapter deals with sport arenas—and in particular with stadiums. It presents the most advanced worldwide practices to show how sport arenas can improve sport clubs' economic performance and fans satisfaction and how they may strongly contribute to create smarter cities. Rebranding stadiums, modernising them to better calibrate their capacity, refurbishing old venues and new stadium projects involve high-level investments, and they require an organisational transformation both for sport clubs and cities. Municipalities and sport clubs can, therefore, be partners in developing technologically advanced and resilient sport arenas and related infrastructures that will be well integrated into the urban design both inside and outside the areas where they are built supporting rather than putting a strain on cities in many ways. A modern stadium must be safe, smart, green, accessible, efficient and innovative: digital solutions let creating a user-friendly urban environment that enhances citizens' wellbeing, welcoming them in a space where emotions and needs can meet.

Keywords Sports · Stadiums · Arenas · ICT · Urbanization · Sustainability

1 Introduction

As cities get smarter, they are becoming more livable and more responsive, however there is still a substantial unrealized potential in smart-cities technology that could contribute to improve the urban quality of life. It affects various dimensions: environmental quality, health, safety, time and convenience, social connectedness and civic participation—just to mention the most relevant aspects. Connectivity among all

A. Baroncelli (✉) · M. Ruberti
Università Cattolica del Sacro Cuore, Milan, Italy
e-mail: alessandro.baroncelli@unicatt.it

A. Visvizi and O. Troisi (eds.), *Managing Smart Cities*,
https://doi.org/10.1007/978-3-030-93585-6_6

assets available in town and the involvement of these assets in the above-mentioned dimensions of the urban quality of life, whether they have extensive legacy systems or are newly conceived and built, it allows to get the more out of the cities' assets and to become smarter. This paper analyses the most advanced solutions introduced worldwide to show how sport arenas can improve sport clubs' economic performance, reducing costs and increasing revenues and how sport arenas—being relevant cities' assets—may strongly contribute to create smarter cities. We aim to analyse and discuss how edge engineering, computing, energy, connectivity technologies allow the redesign of world-class sport and event venues and their integration into the urban infrastructure. Highly sophisticated networked solutions both inside and outside the areas where arenas are built may support in many ways rather than stress urban infrastructures.

The mission of sport clubs as well as other companies in the leisure industry is to provide public entertainment not just to those who wish to enjoy the shows, but also to those visiting these sites—which are among the top-rated touristic attractions in the most visited cities of the world live. Hence, smart arenas in smart cities can also strongly contribute to improve the quality of life of those living around a space designed for attending live events and in any case, they should take into account all impacts they have on the resident population.

People attending live events, expect to be engaged and, for this reason, sport and other companies in the leisure industry are keen to improve the spectators experience and to change their behavior by encouraging the audience to arrive early and stay later, boosting matchday (show) revenue and easing traffic flow in and around the ground. From rebranding, modernisation to resizing capacity to real needs, stadium refurbishments, new stadium projects are becoming headline hitters for the investments they involve and the organizational transformation they require both for sport clubs and cities. Designing new sport arenas or restructuring existing ones according to the up-to-date technological solutions helps smart cities entering a new era. Cities and sport clubs can, therefore, be partners in the creation of modern and resilient development of buildings which can host the main live events and become the beating heart of the city.

We will discuss this theme following different aspects of the modernization of a stadium and the integration of ICT into the project. In the next section, we will highlight how the dynamic connection between municipalities and sport clubs in the creation of a successful master plan for the construction or renovation of sport facilities has a big potential impact on the cities' quality of life as well as on the fans experience in stadiums. As cities get smarter, they become more livable and more responsive. Creating a network of objects and assets capable of smart interactions in the urban environment, a much wider range of technological innovations become available that could help improving public transport, increasing security or providing real-time energy consumption data.

The chapter will continue with four topics that contribute to the deep understanding of the role of sport companies in the cities. The first topic, sport and development of deprived areas, includes the case of Juventus Football Club development of the Continassa area. A second theme, about Improvement of Renewable Energy

and Sustainability Solutions, will be enriched by the display of best practice of Ajax's Amsterdam Arena. The third area of this investigation will be Enhancement of the Event Experience for the Supporters and will depict the solutions offered by the Madison Square Garden of New York. The fourth topic will examine the state-of-the-art technologies in the theme of Management of Human Mobility and People and Premise Security. At last, we will conclude with the final considerations of the general effects of the smart arenas to the cities.

2 Sport and the City. How to Create a Successful Master Plan

The master plan, the programme of works for the renovation or expansion of a new stadium, is the project's lymph. It allows to coordinate all the aspects of the project, following a logical and well-structured process and taking into consideration the budget limits. Through the master planning, sport company and municipalities can work together for defining common goals, such as the enhancement and upgrading of an area of the city. This joint work has led in the past to extraordinary results within the organization of international sport events such as the Olympics game (Burbank et al., 2002; Gold & Gold, 2008; Liao & Pitts, 2006). Although they are only one part of the complete toolkit allowing a city to meet a growing demand from residents to deliver a better quality of life and to do so at a sustainable cost. The concept of 'venue as destination' is now commonplace, sport venues themselves are often regarded as a catalyst for the overall redevelopment of a given city district, including new residential and office space, retail facilities and parking.

We will discuss and show how, thanks to a unity of purpose, even a single sport company can have a positive and significant impact on the development of a suburban area.

There are several technological solutions allowing sport clubs and municipalities to join efforts and make sport venues more successful and cost-effective while improving some quality-of-life indicators within the surrounding urban areas. Among these solutions, probably, the most desired by the residents during the last decade are those related to the improvement of renewable energy and to long term sustainability. According to Manni et al. 2018, stadiums are the buildings with the highest increment of environmental impact, and in Europe, stadiums use up to 40 TWh/year, mostly produced from traditional fossil fuels. A city which desires to step into a sustainable future, needs, therefore, a sharp stadium metamorphosis. In the next pages, we will describe how some sport companies are transforming old-fashion grey stadiums into iconic green arenas.

The stadium has a central role in the sport industry since it is the main place where the fan experience is created, but it is not the only one: sport companies have to try to make the fans choose the stadium over the home tv. The evolution of fans' needs is driving the sport clubs to implement technologies, such as IoT, for engaging

the fans before and after the match. A smart application of technologies drives the club to the optimization of resources and an increase of income. For example, a full Wi-Fi coverage into the stadium can lead to improving fans engagement and to creating a connectivity network. A richer fan journey creates an unforgettable in-person experience and allows selling additional products or service to the crowd, such as drinks delivered to their seats. Sport companies know that the stadium should be open seven days a week and not just the day of the match if they want to improve their business model. A stadium can be then the place for a concert, an e-sport tournament, a business meeting; it can host a museum, a wellness centre or some medical clinics. Or all these things together when transforming the stadium into a physical and digital platform open to third parties, including developers, sponsors, and advertisers on the business side as well as the police, the traffic control, the lighting system, the local school and other public building on the local administration side. This transformation carries with it significant changes for the stadium business model. It shifts its economics from solely selling a stadium experience to a larger value generation for fans, business partners and the local community.

For creating a successful story, the role of sport companies might not be enough. Cities must help them, with an acceleration of the bureaucratical process and the attraction of events which would regenerate the cities themselves and grow the local communities while also enhancing the environment. Almost certainly, one of the main issues the construction projects should take into account is the management of people flows: the optimization of human mobility and fan experience is a critical factor for a sustainable and safe stadium. For this purpose, there are, for example, projects for new systems of intelligent parking lots linked to the stadium via a modern signalling path that, together with gate facial recognition's access, allow the increase of speed and security. Safety and security are the most critical aspects of a modern smart arena. It is crucial that the stadium is perceived by the people as a place of joyful gathering and not as a dangerous zone of the city to avoid during the sport events. Technologies happen to significantly help the sport companies and the municipalities to control and to limit all the problems which have characterized sport events in the past. A modern stadium must be safe, smart, green, accessible, efficient and innovative: digital solutions let to create a user-friendly urban environment that enhances citizens' wellbeing, welcoming them in a space where emotions and needs can meet.

3 Sport Arenas for the Development of Deprived Areas

The link between sport and urban development has been a solid concept in the last decades. The presence of a stadium in a city has a significantly positive effect on land values. This effect decreases as the distance from the stadium increases but it continues playing a role within a perimeter of approximately 3,000 m (according to Ahlfeldt and Kavetsos (2011)) or 3 miles (Tu, 2005). The promotion of city development and regeneration has been recognized as one of the main effects of

hosting major events such as the Olympic Games. The granting of Olympiads offers to the hosting city a chance for a "fast track" regeneration. The effects are various, both economic and social: economic growth, improvement of transportations, and enhancement of global perception and prestige (Chalkley & Essex, 1999). Major sport events benefit on urban development follow the tradition of 19th-century world fairs, even though they became controversial because of cases of corruptions and the unsustainable speed of building (Dendura, 2020; Matheson et al., 2018). Moreover, we can state that a single major event can be an excessive shock for local communities that might rather be at the centre of a slow but significant and continuous growth rather than sudden.

Undoubtedly, the short-term benefits of major events are high to the city's economy, but the local communities need more long-lasting infrastructure developments and a more profound link with the involved players. A more sustainable improvement can be achieved when the interests of the owner of the building and the local communities' ones meet each other. In this section, we will show how the growth of a vast suburban area can be upgraded thanks to a local sport company, who is interested in the long-term development of the area. This part of the chapter covers the story of Juventus Football Club works on the urbanization of an area called "La Continassa", a suburban area adjacent to Juventus Allianz Stadium.

Juventus inaugurated the Allianz Stadium in 2011, building it over the ashes of the former stadium Delle Alpi, an arena built in Torino in 1990 for Italian Football World Cup with public funding from Italian National Olympic Committee (CONI). After a few years, even though Juventus FC performed successfully in national and international competitions, the Delle Alpi stadium was seldom crowded, and the structure itself started to be considered obsolete already since the '90es. The master plan, the programme of works of the renovation or expansion of a new stadium, was indeed lacking. The project failed to improve the Turin suburban area around the arena who was perceived as dangerous by Torino residents, and it was poorly connected to the far city centre. Juventus matches average load capacity was just 70%: one-third of the stadium every match was empty! After some years of attempts, Juventus managed to convince the municipality to give in leasehold the land of the stadium and the surrounding area for a plan who would enhance and upgrade that area of the city.

In just three years, Juventus demolished Delle Alpi and opened the Allianz Stadium. This stadium stands out in Italy for the ability to attract people not only during the matches (94% tickets sold a year compared in the first Allianz Stadium 5 years, compared to an average of 50% of the last 5 years of Delle Alpi) but also during the other days of the week since it opens the concept museum and other commercial activities. Thanks to the Municipality of Turin foresight, Juventus Football Club obtained a leasehold of 99 years on the surface rights to Continassa, an approximately 180,000 m^2 area adjacent to the stadium. In 2013, Juventus and Turin jointly developed a project of regeneration of the zone, which included 80,000 m^2 of public property (Lekakis, 2018).

The master plan was centred around the concept of the Cittadella Juventus: an area formed by a Training Center, a Media Centre, the new Juventus headquarters, an

international school (WINS, World International School Torino) and a concept hotel and store. From a sustainable point of view, BEIT-Bosch will build a power station which will meet all buildings energy demands. According to Puglisi and Baiardi (2019), "the Continassa Area will represent one of the first—replicable—examples in Italy of an urban development project whose energy requirements are satisfied by high-efficiency poly-generation systems and renewable energy sources based on an energy platform of the Smart Grid type". The transportation system was redesigned to serve this renewed area and new bus and metro lines provided to the benefit of the people that are resident in the area as well as of those accessing the stadium facilities.

Thus, thanks to the help of the municipality goodwill, a sport company can have a positive and significant impact on the development of a suburban area. In fact, sport venues are often considered as a catalyst for the overall redevelopment of a given city district and can be a mean for meeting the growing demand from residents to deliver a better quality of life and to do so at a sustainable cost. A smart arena can transform a city into a smart sport city.

A similar effect is expected from the New Tottenham Hotspur Stadium. In addition to creating one of the most technologically advanced stadiums in Europe, Spurs' vision is for the development to serve as the catalyst for a major regeneration project in one of London's most economically deprived neighborhoods. To that end, the broader, Populous-designed masterplan comprises visitor attractions, a 180-bedroom hotel, and an extreme sport centre featuring the tallest indoor climbing wall in the world, as well as new shops, restaurants, public spaces, residential units and a community health centre (Leaders Report, 2018).

4 Improvement of Renewable Energy and Sustainability Solutions

The impact of the sport industry on the natural environment is tremendous (McCullough & Kellison, 2016). The location of sport arenas, which includes not only the stadium but also other facilities, takes up a vast area of a city and has a significant effect on the city social and natural environment (Chen, 2013). Stadiums attract huge crowds not just on match days, but throughout the week, across a range of activities and attractions. Thus, the impact is not only caused by team operations such as inbound and outbound logistics, construction and operation of arenas and practice facilities but also by the visitors' presence and consumption. Since sport events' attendance is a product consumed in person, the overall effect must also include transportation and the pre and post-game activities involving the fans (Collins & Flynn, 2008; McCullough, 2013; McCullough & Kellison, 2016).

Additionally, the energy requirement inside the arenas has increased over time. The modern stadiums do not open just a day per week but continuously operate at extended opening hours since the sport companies base in the stadiums their concept stores, museums, restaurants and other commercial shops. As a result, stadiums are

among the premises with the highest increment of environmental impact, consuming up to 40 TWh/year, mostly produced from traditional fossil fuels (Manni et al. 2018).

Stadium owners and operators started to understand the necessity of joint and coordinated plans to lessen their impact on the environment (Pfahl, 2011). These plans involve the sport companies (through energy upgrades and waste management) and the fans (i.e.: fan engagement programs focussed on green behaviour) (McCullough & Kellison, 2016). A city and a sport company which desire to step into a sustainable future, need, therefore, a sharp stadium metamorphosis. Smart utilities have the added bonus of helping cities create cleaner, healthier, and more pleasant environments while tackling sustainability goals.

This section presents and briefly discuss the case of Amsterdam Arena, possibly the most innovative stadium in Europe that may show one of the state-of-the-art solutions that bring together a more sustainable stadium within one of the "smarter" cities in the world (Fitzgerald, 2016).

The theme of green and sustainable energy has become crucial in the era of climate change, and residents are starting to demand more successful and cost-effective sport venues. The new technologies lead to several solutions on this issue. According to Sfintes (2020), a contemporary building should be a multifunctional and community-oriented, and it should also be seen as a renewable energy producer: the football stadium could use the rainwater not just for irrigating but also for other not potable usage as for the toilets; the solar energy could be transformed into undersoil heating and artificial lighting.

If properly designed, the large building surface could generate very large quantities of renewable resources which can be more than sufficient for the stadium itself and could be used as a power supply for the surrounding street lighting or the neighbour community households (Sfintes, 2020). Some stadiums (e.g. Oceane Stadium—Le Havre in France) started to install high tech renewable energy facilities (like solar panels and wind turbines). Aquino and Nawari (2015) have presented a review of techniques for sustainable stadium design, covering new construction and existing stadia. The world's first solar powered stadium was the National Stadium in Taiwan built for the 2009 World Games. This stadium is comprised of 8,844 solar panels which creates approximately 1.14 million KWh per year (Pham, 2014). This electricity can power 100% of the energy used during game/event days. On non-game/event days the Taiwanese government feeds the electricity created by the solar panels to the grid. This electricity can meet almost 80% of the surrounding neighborhoods requirements and according to the Taiwanese government the renewable energy generated at the National Stadium saves 660 tons of carbon dioxide each year (Alternative Energy News, 2009). The production of renewable energy per se is already a significant step, but not enough.

Other solutions for reducing the impact of the sport events on the environment can be obtained through better management of the resources using an integrated technological system of waste monitoring. With modern technology, such as the Internet of Things, it is possible to optimize the energy consumption by dynamically regulating the lighting and heating, following the weather conditions and the occupancy rate.

The utilization of this technology can be integrated through the application of other improvements, such as a modern plumbing system and recycling programs.

An excellent example of how the design and the ongoing refurbishing of sport arenas meet the goals of major cities since they contribute to the improvement of urban life comes from Amsterdam. "The Amsterdam Smart City initiative encompasses projects across eight categories: smart mobility, smart living, smart society, smart areas, smart economy, big and open data, infrastructure, and living labs. Many of these projects involve stakeholders outside of government" (MIT, 2016). There, Ajax Football Club together with other partners (such as KPMG, Huawei, Microsoft, Nissan and more) has moved forward in the direction of innovation and sustainability, and they are developing a stadium green metamorphosis fully integrated into the overall city masterplan and consistent with its various goals of improvement referred to the sustainable footprint of the city.

Ajax managed to minimize the footprint of the stadium and its visitors, using a blend of proven sustainability procedures combined with innovative technology. The stadium has been used as "a testing ground for developing and testing innovations which would benefit not only the stadium but also the immediate surroundings and society" (Johan Cruijff Arena, 2021).

Thousands solar panels on the roof of the stadium and a wind turbine in Oudendijk have been connected to an energy storage system made by electric vehicle batteries. Lately, photovoltaic electricity production and electric vehicles have significantly increased across Europe. Large-scale battery energy storage systems (BESS) are considered as crucial to enhance the energy supply security for assuring backup resources in order to exploit solar energy in an optimal way (Vo & Nguyen, 2018). Ajax achieved it by building a system capable of storing 3 MW of power, making it Europe's most extensive commercial energy storage system using EV batteries and, arguably, one of the most sustainable stadiums in the world.

Ajax energy consumption management has become more sustainable thanks to the use of LED lighting, energy-generating escalators and connected sensors which analyzing data facilitate the maintenance. The Johan Cruijff ArenA incentives the supporters to reach the stadium with eco-friendly transportations such as electric cars. For this reason, Ajax partnered with Vehicle2Grid for connecting a charging station directly to the stadium storage system. The local production, storage and consumption of green energy is a cornerstone for drawing the landscape of smart cities. Following this principle, the Johan Cruijff ArenA and its partners (Eaton, Nissan, BAM et others) created the biggest energy storage system in a commercial building in Europe. The Johan Cruijff ArenA, in terms of energy, became net climate-neutral and can be therefore considered as one of the most sustainable stadiums in the world.

The last point of this excellent example of the usage of technology for creating a greener future comes from the grass of the arena. Inside the arena, the electric lawn mowers cut tons of grass a year, who would usually be just wasted. In Amsterdam, following the approach of the circular economy, they send this grass to the farm De Dikhoeve for the production of cheese which would be then sold in the restaurant and shop inside the arena!

According to Foster + Partners, the architects who designed the Lusail Iconic Stadium, an 80,000-seat soccer venue that will house the opening and final games of the 2022 FIFA World Cup in Qatar, the stadium will boast a highly-efficient energy saving system, a requirement for FIFA World Cup constructions. Since Qatar's climate is so intense, the building will help cool players and fans. Solar canopies will also hover over the parking and service areas to produce energy for the stadium and power the surrounding buildings.

5 Enhancement of the Event Experience for the Supporters

The sport sector is part of the entertainment industry, a growing business where competition has increased tremendously in the last decades. People who attend sport events are more demanding than in the past, and sport companies must evolve to be able to entertain, engage and retain their customers. Smart venues are the major asset sport companies can work on to achieve this goal removing friction in the fan journey, creating an unforgettable in-person experience and incentivizing fans to come back again. Therefore, in their stadiums sport clubs started to offer a range of different amenities, features, and diversions and implement technologies, such as IoT, for engaging the fans before and after the match. In this way, they would be able to optimize the management of resources and to increase the revenues. Sport companies know that the stadium should be open seven days a week and not just the day of the match if they want to improve their business model.

The sport companies who manage to place arenas at the core of the fan experience can extract extra value from their customers. A fan at home is a less valuable resource than a fan in the stadium! The monetization of the supporters does not depend only on the tickets but also on all the collateral products and services the sport companies can supply to them. With the support of technology, the stadium can become smart and offer a multitude of benefits for the fans, enhancing their engagement and, thanks to customer retention, personalizing the experience inside the stadium.

While a modern designed and a state-of-the-art ICT allows sport company to engage fans with their favourite teams and athletes like it has never happened before, older stadiums can be a disincentive for the supporters, both from an infrastructural and entertainment point of view. In the new arenas, fans could visit seven days a week. They can find a museum to visit, concept stores for shopping, restaurants, shopping malls, business and conference centers, e-games tournament halls, and more. All this integrated with IoT platforms that improve the digital experience and generate huge, crowdsourced data that can be mined for patterns, predictions, and prioritization and possibly made available to the city administration to coordinate operations.

Arenas are the place where every year millions of people gather to enjoy live events and feel unique emotions. That is how arenas became an invaluable asset for the cities. This is why cities must support sport companies, removing the bureaucratical hurdles that prevent to partner in designing or implementing smart solutions. The increase of sport events attractivity generate resources that may held to regenerate the cities

themselves and would give additional economic and social opportunities to the local communities.

The new technologies help sport companies not only to increase traditional revenues but also to generate new sources of revenues. With mobile apps, sport clubs can sell personalized packages which do not include only the tickets but also collateral activities such a walk-about tour, dining at the match or VIP experiences.

A smart stadium must be entirely covered by a Wi-Fi system and integrated with social media spots where to take selfies or pictures for sharing the passion with the online followers, and at the same time having the brand promoted "for free": having the customer experience shared on the social network makes the sport company more attractive to sponsors.

ICT can create a smart environment for the customization of the supporters. The data collected by an application on the smartphones or sensors in the stadium could be an opportunity to sell additional products to the fan according to their seat. It would be optimal for the club to integrate a loyalty rewards programme which would stimulate the fans to increase his/her spending attitude. Social interaction during the matches can be done with the help of cameras (e.g. kiss camera), quiz game, or fantasy game played thanks to the link, via the app, to real-time statistics. Some clubs are also testing the Virtual Reality into the arenas for making the fan experience going beyond.

In the following part of this section, we describe how the above-mentioned strategies for enhancing fans live experience are applied in the self-proclaimed "World's most famous arena": the Madison Square Garden Center (MSG) of New York. MSG opened in 1968, and it is used not only for professional team sport as basketball and hockey, but also for many other entertainments shows like concerts, circuses, and wrestling matches. MSG diversification is a crucial factor for the success of an arena, and in the United States, it is common that an arena can be transformed in few hours, for example, from an ice rink to a basketball court.

MSG offers to the supporters its high performing connecting technology facilitating various entertaining applications. The first MSG flagship is its mobile app. Via the app, customers can manage and personalize their experience before and during the event. MSG App permits to buy, exchange or sell the tickets; it shows available food and drinks nearby, and the customers can buy it avoiding the queue thanks to the "Express Pick Up" lane; it helps the customer to navigate into the arena in order to find the seats from the parking with the fastest route; last, it has several quiz games with which the fans can play and get exclusive prizes.

At MSG it is possible to purchase an "MSG All Access Tour" that takes the customers behind the scenes to a 75-min guided tour. During the tour, the guides will show the backstage areas of the arena, the transformation of the court according to the daily events, and they will let fans play with concept games.

MSG has lately improved the experience of its guests thanks to the implementation of the Virtual Reality (VR). VR technology can make the fans feel the experience of scoring a goal for the NY Rangers or playing for the NY Knicks or even it lets them impersonate Billy Joel playing the piano on a stage surrounded by thousands

of people. Other entertaining activities include concert trivia games, social media pictures stations and boxing strength measurement station.

The visitor will also have access to the exclusive luxury MSG suites and clubs. In fact, MSG invested considerably into the creation and management of premium tickets hospitality, diversified according to the targets. There are three categories of premium hospitality. The first one, Suites and Group Lounges, is a modern setting offered in multiple high-end luxurious suites or group lounges that provide exclusive access.

The second, Club Seating, is a spacious environment where the guests have the freedom to socialize. There are four kinds of clubs that vary with the target of people and they are planned for business relating activities such as Client Entertaining or Networking, following the principle of "See and Be Seen". The third Premium Hospitality access is the Locker Room Experience. This experience is dedicated to the supporters who want to live the feeling of the Knicks (NBA) and Rangers (NHL) before and after the matches, close to their favourite athletes.

In 2018 the Madison Square Garden Company which owns MSG started a partnership with Intel, the global leader in drone innovation, to perform an entirely new entertainment concept by producing outdoor drone light shows, which while promoting its "Christmas Spectacular Starring the Radio City Rockettes" light shows scheduled during the 2018–19 holiday season strongly contributed to lighting the NY's 7th. Str. and entertaining residents and visitors. The NY City Council is now considering a possible relocation of MSG as an integrated part of its city Masterplan to rebuild the arena with the newest technologies and most updated sport industry trends.

The main aim of this section was to illustrate how the integration of advanced technologies into arenas can help sport companies to improve the fans engagement. However, this is not the only message we want to convey. A smart arena is a city's business card, and it is a brilliant image of a city that wants to attract tourists from all over the world, thanks to the global visibility of sports! That is why municipalities and sport companies should work together, reciprocally benefiting from each other's activities, and following the best practices examples that are promoting the idea and the experience of happiness and well-being in smart cities (Visvizi & Lytras, 2020).

6 The Management of Human Mobility and People and the Premise of Security

The management and control of people flows is a crucial issue for the integration of an arena into the urban social context and the improvement of people security. The modern technologies can contribute to the optimization of the crowd mobility and to the prevention of crimes that are still afflicting the sport events. According to UEFA, during the season 2018/19, the 58% of the UEFA Champions League and UEFA Europa League matches had incidents reported inside or outside the premises of the arena. Sport events must instead have a joyful and family-friendly atmosphere, and

the sport companies should implement high-level technologies in order to ensure that matches would be played in a safe environment.

Safety and Security Management in stadiums is based on a few technological novelties that can be applied to all the arenas. This field is pretty recent and the most updated technical may be found in the newest built arena not necessarily those built by the most famous sport clubs.

The Operations Centre for the ordinary and extraordinary event management, consisting of a centre for integrated management of information and activities can provide a picture of the event situation and of the venue in real-time, including emergency and crisis situations. It interfaces external key systems, dedicated to security and safety aspects of major events (i.e. Ministry of Interior, Police, Civil Defence, Fire Brigade). The technological solutions installed within the stadiums are based on Special equipment's (i.e. CCTV system with anti-intrusion; Fire and smoke detection system; Sound system of Emergency Voice Alarm Communication (EVAC); Access Control System; Supervision and Control of Technological Systems (SCADA) and Infrastructure for Secure Communications and Emergency (i.e. Professional radio systems based on TETRA & DMR technologies for voice communications/data, messaging and interoperability with PPDR Organizations (i.e. Police, local emergency services, firefighters). Such infrastructure has been able to interact with existing heterogeneous cities and countries' networks, in order to ensure mission-critical encrypted communications, as well as messaging and user localization systems. In particular, the use of the CSP Communications Service Platform—makes possible the integration of the different networks.

The main distinction we would like to underline concerning security is between the facilitation of human mobility (traffic management) and its monitoring. The first includes all the tools the sport companies provide to the spectators for reaching the arena and moving efficiently into it. The second is about the monitoring of the supporters for preventing crimes and punishing the offenders. Although data generated by facial control technologies placed at the gates could serve both purposes. The installation and the use of this technology may respond to different and unrelated needs.

Sport organizations can manage human mobility to reach and leave the arena, find parking and navigate inside the premises of the stadium. This can be achieved not only with a better organization but also using mobile apps (as shown previously in the MSG case), cameras, and sensors. From an organizational point of view, some clubs have directly linked the arena to public transport stops (e.g. Manchester United built a railway station inside the stadium Old Trafford) while others created partnerships with local mobility partners (e.g. AS Roma Easy Mobility project). From a technical side, the traffic management can be improved with the utilization of mobile apps which will drive the spectators step by step from parking to the seats and could be used for managing the time queue in bars and restroom. The features could include in-seat purchases that would not only reduce the people movement but also increase the clubs' revenues.

The stadium monitoring has considerably improved during the last years thanks to the technology development. Sport companies can rely on a network of cameras

connected to a central room where the controllers keep under surveillance the crowd. A further step has been done by high tech companies such as Leonardo, Panasonic or Bosch, who are specializing in the offer of integrated monitoring systems for arenas. Panasonic developed a facial recognition technology, called FacePRO, that can identify (with high-level of accuracy) all the faces in the crowd starting from pictures on the passport or ID. FacePRO, implemented in Brondby Stadion in Denmark, is effective also in the case the face is partially covered by surgical masks or sunglasses. Bosch has been focussing on a cameras system that, with the IoT technology, is able to recognize without human eye when a person is trespassing the barriers. This service has been already implemented to four big stadiums in Europe (VTB Arena Park in Moscow, PGE Arena in Gdansk, Başakşehir Fatih Terim Stadium in Istanbul, and Ion Oblemenco Stadium in Craiova). Another invention that can increase people speed and security is related to the metal detectors at the entrance of the stadium. Liberty Defense developed a technology, called Hexwave, that detects threat objects (metallic and non-metallic) such as weapons, knives or explosive in a quicker time. This is possible thanks to the utilization of the artificial intelligence on 3D radar that would help the events' organizers to minimize the interruption to the entrance flows. This system has already been implemented by the Allianz Arena in Munich.

Building on the experience gained providing monitoring services at the XX Winter Olympic Games, Leonardo provided a wide assortment of physical security processes to ensure over 20 Games venues at Glasgow 2014 including the Athletes Village. The most advanced security solutions based in the stadiums were also used to train of all local operators to become able to autonomously manage the security system also in ordinary city security monitoring.

A final issue is worth to point out is the challenge that sport clubs are facing with Covid-19 pandemic. Nearly all sport events have been cancelled since March 2020 and started to take place crowdless, a few months later. In the major European sports leagues, a minimal number of spectators are admitted into the arenas with tight restrictions. This could be more safely managed if the companies would use apps and technology for coordinating the flow of people, measuring their body temperature with thermoscanners and monitoring that supporters abide by the distance required and the obligation to wear masks. Apps can also be useful for tracking the people movements inside the arena: in the case of an in-arena contagion, it would be simpler for the supporters and for the health authority to learn who had been close to the Covid-19 positive supporters.

7 Conclusions and Recommendations

The critical enabler to make cities achieving growth that is both sustainable and inclusive is digital technology. The goal is to view digital technology (as well as the three utilities: water, gas and electricity) as part of a holistic approach to revitalizing

cities. Improving transportation services and sustainability, reducing wastes, heightening safety and security, parking services, social and medical services should be part of a city masterplan that involves all infrastructure and construction projects.

Building or restructuring sport venues with networking technology produces digitization and connectedness that generate an atmosphere where the arena comes alive engaging fans, teams, and sponsors both physically and digitally. The innovative digital engagement and monetization strategies that align with in-venue assets and cater to customers, fans, service partners, sponsors, and teams create a self-sustaining ecosystem which also contributes to improving the overall city transport, power, water, and waste systems.

However, digitizing arenas is a considerable investment. Since live events are organized few times a month, stadiums and venues need to find advanced methods to generate and monetize opportunities for getting a higher returns on their digital investments.

Since some sporting events attract a few thousand people, stadiums present a tremendous business opportunity for neighboring establishments such as F&B outlets, hotels, cinemas, merchandise shops, and more. By partnering with these businesses and offering a flexible in-venue solution that connects fans to these stadium partners, venues can create new monetization opportunities within the local business community. At the same time, considering major sport venues as an integrated part of the overall facility systems of the city may determine a contribution to the smart city development.

In Europe some stadiums are held by the football clubs; however, the large majority of them is part of the municipalities' assets. Although challenging in practice, involving the private sector into the effort to provide funding, technical know-how, and innovation that complements public-sector efforts can make the transition to a smart city faster and consistent (McKinsey & Company, 2018) Whatever the ownership of the sport venues, if regarded as a part of a synergic effort to transform cities into smart cities, stadiums can strongly contribute to physically expand on the urban territory the diffusion of smart city technologies. The higher the integration of the new technologies of the stadiums in the overall smart technologies of the cities the lower the required public investments (should the ownership of sport venues be private) and the faster the "payback"—both in monetary and environmental terms-of the investments.

References

Ahlfeldt, G. M., & Maennig, W. (2010). Impact of sports arenas on land values: Evidence from Berlin. *The Annals of Regional Science, 44*(2), 205–227.

Ahlfeldt, G. M., & Kavetsos, G. (2011). Form or function? The Impact of New Football Stadia on Property Prices in London, SERC Discussion Papers, Spatial Economics Research Centre, LSE. http://EconPapers.repec.org/RePEc:cep:sercdp:0087

Alternative Energy News. (2009, May 30). *New solar stadium in Taiwan*. Retrieved October 10, 2020, from http://www.alternative-energy-news.info/new-solar-stadium-in-taiwan/

Aquino, I., & Nawari, N. O. (2015). Sustainable design strategies for sport Stadia. *Suburban Sustainability, 3*(1). Article 3. https://doi.org/10.5038/2164-0866.3.1.1020

Burbank, M. J., Andranovich, G., & Heying, C. H. (2002). Mega-events, urban development, and public policy. *Review of Policy Research, 19*(3), 179–202.

Chalkley, B., & Essex, S. (1999). Urban development through hosting international events: A history of the Olympic Games. *Planning Perspectives, 14*(4), 369–394.

Chen, X. J. (2013). The green energy-saving design of stadium. *Advanced Materials Research, 724*, 1571–1574. https://doi.org/10.4028/www.scientific.net/AMR.724-725.1571

Collins, A., & Flynn, A. (2008). Measuring the environmental sustainability of a major sporting event: A case study of the FA Cup Final. *Tourism Economics, 14*(4), 751–768.

Dendura, B. (2020). Olympic infrastructure—global problems of local communities on the example of Rio 2016, PyeongChang 2018, and Krakow 2023. *Sustainability, 12*(1), 141.

Fitzgerald, M. (2016). Data-driven city management. A close look at Amsterdam's smart city initiative. *MIT Sloan Management Review*. Reprint #57470.

Gold, J. R., & Gold, M. M. (2008). Olympic cities: Regeneration, city rebranding and changing urban agendas. *Geography Compass, 2*(1), 300–318.

Johan Cruijff Arena. (2021). *About us.* Retrieved October 21, 2021, from https://www.johancruijffarena.nl/en/over-ons/duurzaamheid/

Leaders Report. (2018). *The next generation stadium.* HKS Sports and Entertainment.

Lekakis, N. (2018). The urban politics of Juventus' new football stadium. *Journal of Urban Research.*

Liao, H., & Pitts, A. (2006). A brief historical review of Olympic urbanization. *The International Journal of the History of Sport, 23*(7), 1232–1252.

Manni, M., Coccia, V., Nicolini, A., Marseglia, G., & Petrozzi, A. (2018). Towards zero energy stadiums: The case study of the Dacia arena in Udine, Italy. *Energies, 11*(9), 2396. https://doi.org/10.3390/en11092396

Matheson, V. A., Schwab, D., & Koval, P. (2018). Corruption in the bidding, construction and organization of mega-events: An analysis of the Olympics and World Cup. In M. Breuer & D. Forrest (Eds.), *The Palgrave handbook on the economics of manipulation in sport* (pp. 257–278). Palgrave Macmillan.

McCullough, B. P. (2013). Identifying the influences on sport spectator recycling behaviours using the theory of planned behaviour. *International Journal of Sport Management and Marketing, 14*(1–4), 146–168.

McCullough, B. P., & Kellison, T. B. (2016). Go green for the home team: Sense of place and environmental sustainability in sport. *Journal of Sustainability Education, 11*(2), 1–14.

McKinsey & Company. (2018, November). *How can the private and public sectors work together to create smart cities?*

MIT Sloan Management Review. (2016). *Six lessons from Amsterdam's smart city initiative.*

Pfahl, M. (2011). *Sport and the natural environment: A strategic guide.* Kendall Hunt Publishing Company.

Pham, D. (2014, July 29). Dragon-shaped solar stadium in Taiwan is 100%. *The Sun.* Retrieved November 30, 2019, from http://inhabitat.com/taiwans-solar-stadium-100-powered-by-the-sun/2/

Puglisi, V., & Baiardi, L. (2019). Sports facilities: The transition from the "Cost System" model to the "Revenue System" model. In *3rd. World Multidisciplinary Civil Engineering, Architecture, Urban Planning Symposium*, WMCAUS 2018 Institute of Physics Publishing (Vol. 471, No. 2, pp. 022037–022047).

Sfintes, R. (2020). Football stadium: An energy-efficient building and a source of renewable energy for the community. In A. M. Dabija (Eds.), *Energy efficient building design.* Springer.

Tu, C. C. (2005). How does a new sports stadium affect housing values? The case of fedex field. *Land Economics, 81*, 379–395.

Visvizi, A., & Lytras, M. D. (2020). Sustainable smart cities and smart villages research: rethinking security, safety, well-being, and happiness. *Sustainability, 12*(1), 215. https://doi.org/10.3390/su12010215

Vo, T., & Nguyen, P. (2018, August). Amsterdam ArenA stadium: Real-time smart battery energy storage system coordination for voltage support. In *2018 IEEE Power & Energy Society General Meeting (PESGM)* (pp. 1–5). IEEE.

Alessandro Baroncelli, Ph.D., Università Cattolica del Sacro Cuore, Milan, Italy. His research interests include smart cities, sport management, sport facilities management.

Massimo Ruberti, Ph.D., Università Cattolica del Sacro Cuore, Milan, Italy. His research interests include smart cities, athletics, athletic facilities management.

Managing Business and Entrepreneurship in the Smart City

Crowdfunding as a Smart Finance and Management Tool: Institutional Determinants and Well-Being Considerations. Evidence from Four Central and Eastern European Countries

Mina Fanea-Ivanovici and Marius-Cristian Pană

Abstract The paper at hand deals with crowdfunding as a web 2.0 technology that has recently penetrated traditional finance. Crowdfunding promises to improve access to finance to larger numbers of citizens and businesses, by bringing together demand and supply of available funds on a digital platform outside the well-established regulated banking system. Crowdfunding depends on technology-related factors, but also on the regulatory framework in terms of traditional financial activity and crowdfunding legislation progress. Country-specific credit and financing conditions on the regulated financial market may explain the search for alternative financing methods. These factors are analyzed for four Central and Eastern European (CEE) countries, Bulgaria, Hungary, Poland and Romania. We also analyze the influence of increased well-being on crowdfunding development in the selected countries in order to explain that the former is a determinant of crowdfunding development even in the absence of specific crowdfunding regulations. Crowdfunding covers financing needs for personal and business projects, but also for civic projects in the context of smart city development. Therefore, it is an instrument to be considered by city managers, as well.

Keywords Crowdfunding · FinTech · Institutional framework · Sharing economy · Well-being

M. Fanea-Ivanovici (✉) · M.-C. Pană
Department of Economics and Economic Policies, The Bucharest University of Economic Studies, 6 Piaţa Romană, 010374 Bucharest, Romania
e-mail: mina.ivanovici@economie.ase.ro

M.-C. Pană
e-mail: marius.pana@economie.ase.ro

A. Visvizi and O. Troisi (eds.), *Managing Smart Cities*,
https://doi.org/10.1007/978-3-030-93585-6_7

1 Introduction

The information society has brought about major changes in most fields of activity, including economy, finance, education, defense, communication, healthcare, transportation, and, therefore, managed to improve the level of well-being among citizens (Lytras & Visvizi, 2019). In addition, the collaborative economy has recently started to change the way of doing business in various areas, such as: commerce, finance, learning, travelling, rental, cultural production. Besides the obvious business opportunities opening up for entrepreneurs, citizens now benefit from faster, better and more convenient products and services. The new forms of collaboration can contribute to economic growth, the development of smart cities and community building (Care et al., 2018). Smart city development can be achieved through use of information and communication technologies, which become an effective instrument in the hands of policymakers (Lytras & Visvizi, 2020; Lytras et al., 2020; Visvizi et al., 2017). Internet-based information systems have enabled various forms of collective intelligence, action and resources, such as: open source software, mobile applications, innovation marketplaces, crowdsourcing, and crowdfunding (Feller et al., 2017; Torres-Ruiz & Lytras, 2019). Apart from crowdfunding, other FinTech recent advances include: cryptography, cryptocurrency, blockchain, data analytics, and machine learning (Mendoza-Tello et al., 2018, 2019; Visvizi et al., 2018). Such disruptive innovations in finance have influenced population well-being by making transactions easier, faster, and cheaper, with implications for the entire financial services sector, business capitalization strategies, and personal and community development (Feller et al., 2017; Omarova, 2019).

Civic crowdfunding has emerged as a financing solution for local initiatives and projects. It consists of raising money from the community, the amounts being used for public interest projects. "Civic crowdfunding contributes to citizens' empowerment since it allows them to collectively increase their well-being and solve societal issues (World Urban Campaign, n.d.)." Because the community finances certain projects, citizens actually choose what the projects of interest are, and they become an active part of local planning and development. Besides, the future community well-being depends on the number of backers and the size of their contributions. When public funding is insufficient, and private initiative is scarce, civic crowdfunding may be one of the alternatives to help to implement municipality projects. Unlike other types of crowdfunding, the pool of online backers is part of the well-determined offline community, which is represented by city inhabitants. The most active civic crowdfunding platforms are: ioby.org, voorjebuurt.nl, spacehive.com and co-citoyens.fr. The host countries of these platforms are the US, the Netherlands, the UK and France. A noteworthy remark is that all the four countries have regulated crowdfunding. Therefore, crowdfunding regulation is the main reason why this financing method has extended to also reach municipality projects. It therefore becomes a useful instrument at the hands of city managers.

This paper analyzes the environment within which crowdfunding as an emerging FinTech is developing in a selection of four countries—Bulgaria, Hungary, Poland,

and Romania, and discusses the influence of increased well-being on the further development of this financing method.

The Organisation for Economic Co-operation and Development (OECD) has contributed to the development of the notion of "multi-dimensional well-being", which encompasses opportunities for upward social mobility and for improving people's lives, translating these opportunities into well-being outcomes for all segments of the population, reducing inequalities, and fostering environmental and social sustainability (OECD, 2019a). The well-being dimensions proposed by the OECD are: income and wealth; jobs and earnings; housing conditions; work-life balance; health status; education and skills; social connections, environmental quality; civic engagement and governance; personal security and subjective well-being (OECD, 2018). A well-being strategy for Europe, as seen through the lenses of the OECD, provides that meeting financial challenges could be achieved by establishing effective private/public partnerships for promoting well-being and mobilizing private finance for social impact investment (OECD, 2019a). In this context, crowdfunding and other FinTech can improve citizens' well-being within three of the dimensions, i.e. income and wealth; jobs and earnings; and social connections. FinTech enhances financial accessibility and inclusion by addressing several current financial frictions: (1) cost barriers for delivering financial services, especially for marginalized groups; (2) information asymmetries between consumers and service providers, which do not allow for an adequate risk assessment; this is enabled by more granular information on borrowers and better matching and pooling of savings and investment, which leads to more diversified and decentralized international finance; (3) lack of verifiable identity documents and difficulty in meeting customer due diligence requirements; and (4) lack of suitable financial products for lower income segments (International Monetary Fund [IMF], 2019a). Therefore, the development of crowdfunding positively influences the well-being of those benefiting from funds (i.e. the demand-side within crowdfunding transactions). Besides this obvious correlation described above, (i.e. crowdfunding contributes to a higher level of well-being for citizens benefiting from it), we argue that higher levels of well-being can, in turn, lead to crowdfunding growth and development, whether or not specific crowdfunding regulations are in place. More precisely, a wealthier population is more willing and able to finance crowdfunding projects (i.e. the supply-side within crowdfunding transactions), thus leading to the development of this phenomenon.

Crowdfunding as an exponent of the collaborative economy has emerged as part of the alternative finance (AltFi) both for businesses and for citizens, and is mediated by a digital platform (Gleasure et al., 2019; Jenik et al., 2017; Vealey & Gerding, 2016). AltFi refers to technology-enabled market-based funding outside the traditional financial system. It comprises consumer and business lending, invoice trading, and third-party payment platforms (Morschheuser et al., 2019). In crowdfunding, information technology harnesses under-utilized resources via more effective coordination (Morschheuser et al., 2019).

The aim of this paper is to analyze the framework within which crowdfunding can develop by taking into account factors related to: (1) information technology (IT), (2) regulations, and (3) economic conditions. IT-related factors include broadband

coverage/availability, penetration of Internet connections in households and enterprises, Internet users, use of online banking services and of social networks, digital skills among Internet users, the share of individuals experiencing financial losses in the digital environment, and individuals' security concerns regarding online orders and purchases. The regulatory framework is analyzed in terms of flexibility or rigidity of the existing financial regulations to accommodate new types of financing methods. Then, an investigation into the countries' traditional credit conditions is performed in order to assess the extent to which this factor represents an incentive or a deterrent for alternative types of financing to appear and develop. Noticing that the regulatory framework has not been developed to encourage crowdfunding in these countries, we show that this smart finance tool still grew, and this happened due to the increased levels of well-being in these countries.

The four analyzed countries belonging to Central and Eastern European (CEE) are particularly important from a research standpoint as they occupy trailer positions in European rankings concerning the development of the digital economy and society. To exemplify, the Digital Economy and Society Index (DESI) calculated for the year 2019 places Hungary on the 24th position, Poland on the 26th position, Romania on the 28th position, and Bulgaria on the 29th position, in the total of 29 EU countries. The conclusions of the research are useful for designing adequate policies to stimulate crowdfunding, which is seen as both as a determinant of citizens' financial well-being and also a result of population's increased well-being (European Commission [EC], 2019a).

The paper is original in that, to the best of our knowledge and belief, there are no other studies comparing the crowdfunding environment for more than one CEE country. It also discusses crowdfunding and smart finance and management benefits, which include more accessible and inclusive finance for citizens, but also the impact of well-being on the development of crowdfunding. Last but not least, the conclusions of the study may prove useful for city managers and urban planners, as this new instrument has financed multiple civic projects in several countries.

2 Literature Review

It has been argued that crowdfunding is a social inclusion instrument, as it sometimes is the last resort "to ensure access to basic commodities, essential to the daily life and well-being of individuals" (Paredes et al., 2018). Due to its social potential and impact, crowdfunding can be largely adopted for social causes. Crowdfunding can also play an important role in city development, especially through civic crowdfunding campaigns that bring together citizens and central and local authorities (Care et al., 2018). Crowdfunding campaigns are particularly important for urban areas. It has been shown that, rural areas have lower crowdfunding success rates than urban areas (Gallemore et al., 2019). Civic crowdfunding combines private funding initiatives and local development initiatives, leading to city development. In this context,

crowdfunding expansion is critical in order to be integrated into local government policy (Brent & Lorah, 2019).

According to the European Parliament resolution of 9 July 2015, a Capital Markets Union "should create an appropriate regulatory environment that enhances cross-border access to information on the companies looking for credit, quasi-equity and equity structures in order to promote growth of non-banking financial models, including crowdfunding and peer-to-peer lending" (EC, 2016, p. 4). Crowdfunding growth is one of the objectives on the EU Digital Single Market agenda as well.

Crowdfunding has become an alternative solution to traditional banking financing especially for companies or projects with insufficient resources, which are not eligible for bank loan applications (IMF, 2019a; Gleasure et al., 2019). In business, "crowdfunding is a diffused project finance practice for funding early-stage projects by directly involving a large number of people by means of remote interaction through ICT-enabled platforms" (Davies & Giovannetti, 2018, p. 118). Originally, crowdfunding would finance projects involving a high degree of risk and uncertainty, such as research and development, innovation, hi-tech, prosocial campaigns or cultural production. Later on, crowdfunding grew to virtually address any type of project.

The European Commission defines crowdfunding as "an emerging alternative form of financing that connects those who can give, lend or invest money directly with those who need financing for a specific project. It usually refers to public online calls to contribute finance to specific projects" (EC, n.d.).

The three crowdfunding parties are: (1) the project initiator or the fund seeker, (2) the investor, creditor, backer or donor, who provides the funds, and (3) the crowdfunding platform, which is a virtual market for available funds, which reunites the first two categories. The platform operates as a mediator between fund seekers and the crowd.

Depending on the type of transaction, crowdfunding can be: (1) donation-based (a project is financially supported by donors in exchange of no financial or non-financial reward); (2) reward-based (non-financial rewards are offered to project backers, the transaction being assimilated to pre-ordering, whereas backers become early buyers); (3) lending-based (backers are paid an interest as in the case of a traditional loan, and they become creditors); (4) equity-based (the backer becomes an investor); (5) hybrid forms of crowdfunding.

The above crowdfunding models are those usually found on crowdfunding platforms. However, new crowdfunding paradigms have started to appear, such as replacing third-party crowdfunding platforms by embedding crowdfunding technologies directly into project initiators' websites (Gleasure & Morgan, 2018) or by propagating and integrating crowdfunding technologies into novel hybrid or proprietary contexts (Gleasure et al., 2019). In highly specialized areas, e.g. food safety and quality, it is argued that crowdsourcing and crowdfunding are useful tools of the big data domain by utilizing the crowd's data in various activities, such as: shelf-life monitoring, inventory control, foodborne illness surveillance, identification of contaminated products, improvement in food business hygiene, enhancement of food safety, communication, allergen management, risk minimization (Soon & Saguy, 2017).

Although crowdfunding provides financial inclusion, flexibility, and reduces time and transaction costs, it is not free of risks. Besides platform-associated risks, i.e. errors, breakdowns, and cyber-attacks, business and economic risks include liquidity risk, moral hazard, fraud, fake campaigns (EC, 2016; Zenone & Snyder, 2019).

The choice of a crowdfunding platform depends on the website functionalities, such as layout, audiovisual facilities, and secure and easy payment methods. Other important elements to be considered are: information transparency regarding current and past projects, real-time and visible updating of financial information, and comment section that ensures permanent communication between project initiators and the crowd. Visibility and traceability are crucial for crowdfunding project success. When backers conceal information, this has a negative effect on subsequent visitors' conversion and contributions (Burtch et al., 2016). However, privacy control mechanisms have a significant impact on fundraising. Thus, reducing access to information controls generates an increase in the amounts raised, but the average contribution decreases due to tempering of extreme contributions (Burtch et al., 2015). Financial information should be easily identified during and after the crowdfunding campaign. Thus, of utmost importance are: the currently raised amount, the number of backers, the time left until the end of the campaign, a specific section of updates regarding the project, how the money was used during project implementation, the modality of reimbursing the money in case of project failure (Fanea-Ivanovici, 2019). Apart from platform design and quality, content, easiness of navigation, transaction convenience, security and feedback, project content quality, equally important factors are: reliability, integrity, openness, and perceived concern (Liu et al., 2019; Busse, 2018). Besides such features, equally important in order for a crowdfunding platform to reach maximum performance is to apply certain control systems, e.g. acceptance rate and diffusion density (Yang et al., 2016).

The role of social networks in successfully conducting crowdfunding campaigns has been demonstrated in numerous studies. Certain authors argue that social interaction through a wide social network, inter alia, boosts the probability of achieving the crowdfunding goal (Madrazo-Lamarroy et al., 2019; Kindler et al., 2019; Borst et al., 2018; Dai et al., 2018; Kang et al., 2017; Kromidha & Robson, 2016). Social network effects prevail to the detriment of traditional economic explanations—the contributions of people on social networks are typically small, and fundraising success depends on "Web capacity" (Saxton & Wang, 2014). On a similar note, the success of crowdfunding campaigns also depends on the social network structure among individuals advocating for the campaign on the social media, as well as on the volume of the social media activity around a campaign (Hong et al., 2018). Social networks and discussion forums have a major impact on crowdfunding campaign success because they develop effective word-of-mouth (Lagazio & Querci, 2018). Last but not least, information cascades among individual investors facilitated by the use of a public profile may increase the appeal of the offer among early investors (Vismara, 2018).

Other authors, however, suggest that the social media play a minor role in addressing specific aspects in crowdfunding campaigns, such as sustainability (Laurell et al., 2019).

The backers' involvement may sometimes exceed its original financial purpose, as they sometimes get involved in product development, thus becoming prosumers (Alderete, 2017; Planells, 2017; Ritzer, 2015; Ritzer & Jurgenson, 2010; Siuda & Troszynski, 2017). Project initiators allow this additional involvement especially in reward-based crowdfunding because this method is often considered to develop products in line with market needs. In this context, crowdfunding serves as a digital platform market-oriented innovation (Eiteneyer et al., 2019). Prosumerism in crowdfunding is another argument for the technology's potential to increase citizens' consumer satisfaction and increased well-being.

On one hand, crowdfunding platforms have started to launch standardized reputation evaluation systems in order to provide the investors with the possibility to evaluate the quality of entrepreneurship program and service. Therefore, an Internet-finance reputation mechanism has been created (Wang et al., 2019). On the other hand, certain reward-based crowdfunding platforms have relaxed the previously stringent screening process for new campaigns, as is the case of Kickstarter. As a result, increased openness led to a higher number of projects to be posted on the platform, whereas backers started to face higher risks. Changing the balance from control to openness may increase platform revenues from commissions, but it may deter backers (Wessel et al., 2017).

Crowdfunding develops insofar as general financial regulations or specific regulations allow it (Vismara, 2016). In 2012, the Jumpstart Our Business Startups (JOB) Act rendered crowdfunding activity legal in the United States. One of the benefits of the Act is that it exempted crowdfunding from expensive registration requirements and allowed crowdfunding platforms to avoid the classification of broker, which would have further increased the costs of platforms' operation. The law helped underfunded entrepreneurs and small businesses, but without exempting backers from risks (Stemler, 2013). Title II of JOBS Act legalized interstate equity crowdfunding, and 18 states had passed legislations or regulations allowing such interstate financial activity as of 2018 (de la Vina & Black, 2018).

Later on, many other European countries enacted crowdfunding in different manners. In some countries, crowdfunding investors and companies benefit from tax incentives, e.g. United Kingdom, France, Italy, Spain, and Belgium. This measure is aimed at reducing the system's dependence on the traditional banking system and at increasing credit availability for small and medium-sized enterprises. The most frequent form of tax incentive is up-front tax credit on the amounts invested in early-stage ventures (Cicchiello et al., 2019). Due to different regulations across Europe, this financing method worked in those countries with populations that are large enough to make it economically feasible. National limitations on crowdfunding de facto are the results of limits *de iure,* according to Zetzsche and Preiner (2018). The main menace is that, in the absence of harmonized regulations on European level, crowdfunding is likely to remain national or even local. Crowdfunding could become a cross-border financial tool if there is a minimum level of protection for investors and if costs are kept at a minimum for the platform operation (IMF, 2019a; Zetzsche & Preiner, 2018). However, too strong investor protection may harm small firms and business initiatives; this is why optimal regulation depends on whether or

not there are other financing methods for early-stage financing, e.g. venture capital, and business angels (Hornuf & Schwienbache, 2017). At the same time, crowdfunding has raised questions regarding disclosure requirements, the applicability of securities regulations (IMF, 2019a).

Legal gaps and inconsistencies are found in other countries, too, such as China. The users' engagement in crowdfunding refers to regulatory arbitrage and pursuit of short-term profits, which distort the market. The main goals of regulation are to ensure market transparency, competition, and fair pricing (Yang et al., 2018).

The UK is one of the first countries to have put in place FinTech regulations, in 2016. The European Commission drafted a FinTech action plan and put forward new rules to help crowdfunding platforms to expand across the EU's single market (IMF, 2019a).

3 Materials and Methods

The paper analyzes the general framework in Bulgaria, Hungary, Poland, and Romania in order to assess to what extent they are prepared to use crowdfunding as a smart finance tool on a large scale. As shown above, crowdfunding is an instrument that can lead to smart city development, social and financial inclusion, and enhancement of citizens' well-being.

The first analyzed component is that of IT-related factors: *connectivity* (measured through Internet coverage and access among the population and/or businesses); *Internet usage*, both from a quantitative perspective (measured through frequent Internet users) and from a qualitative perspective, highlighting the sophistication of usage (measured through use of online banking, and participation in social networks among the population and/or businesses), *IT skills* among population (measured through individuals with IT skills through formal IT education, and individuals with at least basic IT skills), and *menaces* regarding Internet transactions among population (measured through individuals experiencing financial loss, and security concerns regarding online purchases). The official web site of the European Commission, the section regarding the Digital Single Market is the source of data (EC, 2019b). Due to the discontinuous data reporting, the variables analyzed cover different time intervals.

The second component of the research is an investigation into general or specific crowdfunding regulations, whereas the third deals with economic factors having impact on the crowdfunding market. The economic factors mainly refer to the interest rates on the traditional financial markets, i.e. interest rates for deposits and loans. The rationale for this analysis is that crowdfunding represents an alternative to traditional banking markets. In this context, it is important to assess the opportunity cost of resorting to one or another. Information regarding crowdfunding regulations was obtained from the official reports issued by the European Crowdfunding Network [ECN] (2017) and the European Commission (2017). The interest rates were taken from the International Monetary Fund (IMF) database (IMF, 2019b) for Bulgaria, Hungary and Romania, and from the Polish National Bank for Poland (Narodowy

Bank Polski [NBP], 2019). Additionally, an assessment of the financial market using IMF data for the four countries is made (IMF, 2019c).

Technological, economic, and regulatory factors have been recognized to be the main determinants of crowdfunding development in the specialized literature (Jenik et al., 2017). In the fourth part of the analysis, the paper aims to highlight another important aspect, which is the influence of well-being on crowdfunding. We start from the hypothesis that a high level of well-being is an efficient drive for crowdfunding growth, especially for reward-based and donation-based models. In order to check this hypothesis, we used qualitative analysis methodology. The data we used are provided by Eurostat and include three indicators: mean equivalized net income in purchasing power standard (PPS), (Eurostat, 2019a) employment and activity, percentage of total population, age 20–64 years (Eurostat, 2019b) and at least upper secondary educational attainment, age 25–64 years (Eurostat, 2019c). These indicators are relevant expressions of well-being, as it results from the OECD reports, mainly those referring to Better Life Index (BLI) (OECD, 2018, 2019a). A proper solution to express well-being would have been the use of BLI itself. However, from a methodological point of view, BLI has a major shortcoming: the data are not comparable from one edition to the other (OECD, 2019b). Moreover, BLI data are only available for Hungary and Poland, and not for Romania and Bulgaria. For this reason, the choice of the well-being indicators had to be adapted in order to reflect the topic and to address methodological constraints. Thus, among the BLI components, we chose household net adjusted disposable income as an expression of the Income and wealth dimension of well-being, employment rate to express the Jobs and earnings dimension of well-being and educational attainment to express the Education and skills dimension of well-being. The choice of these BLI components is justified by the need to adapt the well-being indicators in order to enable the qualitative analysis of the influence of said indicators over the dimension of the crowdfunding phenomenon. Therefore, household net adjusted disposable income and employment rate can explain the existence of financing sources for crowdfunding transactions. We use the hypothesis according to which there is a positive correlation between disposable income and employment rate, on one hand, and the amounts raised and used through crowdfunding, on the other hand. Educational attainment can be a useful indicator to understand the degree of use of digital skills in crowdfunding. Here we use the hypothesis of a positive correlation between educational attainment and digital skills.

Under these conditions, the Eurostat data used address the methodological constraints and the topic proposed as follows: mean equivalized net income in purchasing power standard (PPS) to express household net adjusted disposable income, employment and activity, percentage of total population, age 20–64 years to express employment rate, and at least upper secondary educational attainment, age 25–64 years to express educational attainment.

4 An Analysis of It-Related Factors

We selected the most relevant data on *connectivity, Internet usage, IT skills and menaces* for Bulgaria, Hungary, Poland and Romania, in order to compare their evolution in time, and against the EU average. This section is an X-ray of how IT-related factors have evolved in the analyzed countries. Technological infrastructure is the first condition for crowdfunding to grow and develop. A country with generalized coverage and access to the Internet, with a large number of frequent Internet users, and with households and businesses sophisticating Internet usage beyond information and communication, i.e. for online banking and social media, is more likely to use Internet-based FinTech than other countries. Also, a country in which most of the population has IT skills will sophisticate the purposes of using the Internet and web-based technologies than others. Last but not least, advanced forms of smart finance, such as crowdfunding, will thrive in countries where incidents occurring while transacting on the Internet have a low frequency.

4.1 Connectivity

Analyzing the standard fixed broadband coverage/availability (as a % of households) (SFB) and 4G mobile broadband (LTE) coverage (as a % of households) (4G), we identify large disparities between the countries (Fig. 1). Thus, the four countries are all situated below the EU average in terms of SFB between 2013 and 2018. The worst performing country is Poland, with the lowest coverage, at about 80%, followed by

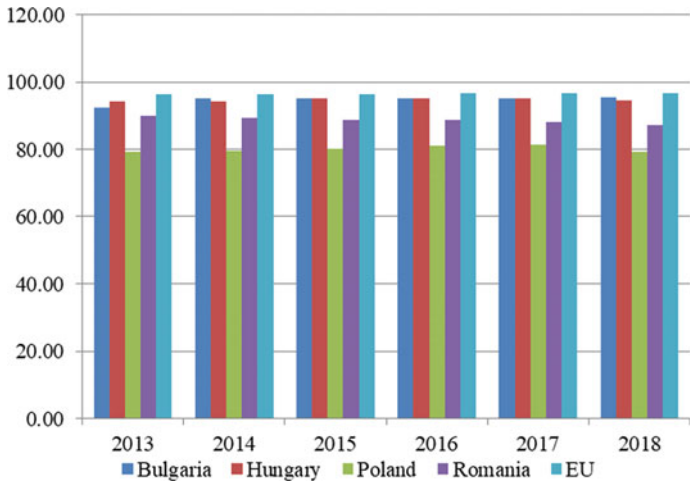

Fig. 1 Standard fixed broadband coverage/availability (as a % of households), 2013–2018

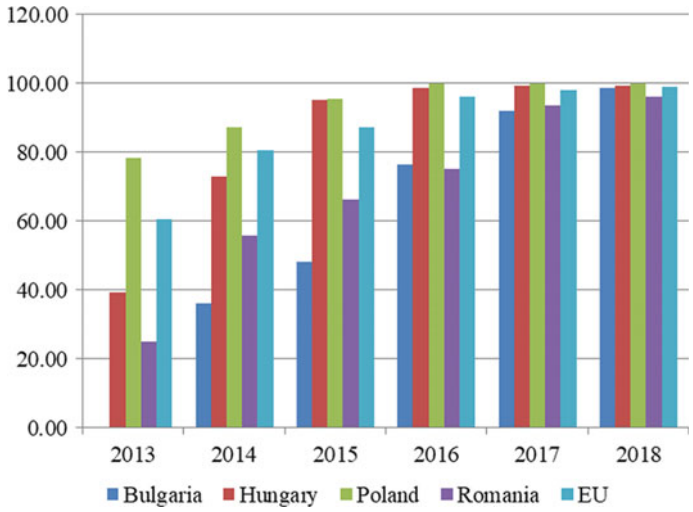

Fig. 2 4G mobile broadband coverage (as a % of households), 2013–2018

Romania, at about 90%. The best performing countries in terms of FSB are Bulgaria and Hungary.

The countries' performance in terms of 4G has improved over time, with some countries exceeding the EU average—Poland for the entire time interval, and Hungary between 2015 and 2018 (Fig. 2). Nonetheless, 4G in Bulgaria and Romania has extended in an accelerated manner, from less than 40%, and less than 55%, respectively, in 2014, to almost 99%, and 97% respectively, in 2018. Obviously, all analyzed countries have converged to almost 100% coverage in terms of 4G in an accelerated manner, closely following the EU average, as compared to FSB. In terms of FSB, larger gasps among countries still exist, although the coverage has been equal to or higher than 80% starting from as early as 2013.

There has been a positive evolution in terms of households having a broadband connection (HBC), the four countries being on a catching-up trend with the EU average (Fig. 3). In 2006, Bulgaria and Romania were at less than 10%, and Hungary and Poland at around 20%, while the EU average was 30%. The rate of increase in HBC has been a steady one, with Poland and Hungary having the best HBC values. Starting from 2013, Romania surpassed Bulgaria, and its performance improved to the extent to which it almost managed to equalize the Polish HBC rate. Overall, Hungary managed to reach the highest value, of more than 80% in 2018.

Although broadband connection may be a good tool to assess households' overall degree of Internet connection, all types of connections are shown in Fig. 4 for the same time interval, 2006–2018, using the indicator Households with access to the Internet at home (HIH). As in the case of HBC, the four countries are below the EU average; however, HIH is significantly higher than HBC. Similarly, Poland and Hungary are the best performers, followed by Romania and Bulgaria. In 2018, Romania managed

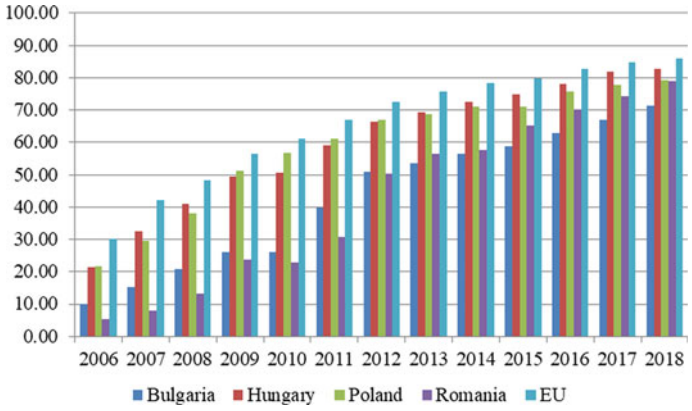

Fig. 3 Households having a broadband connection, 2006–2018

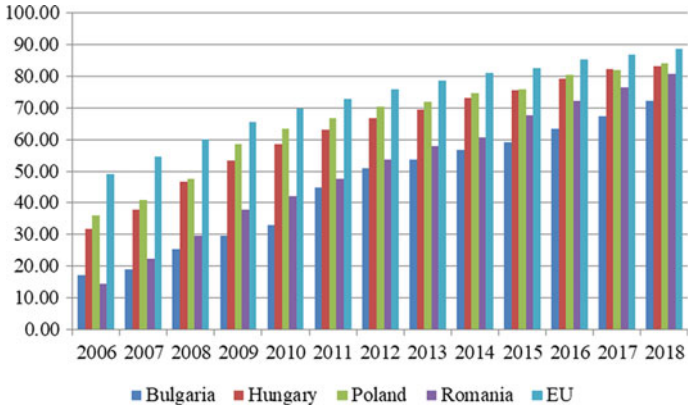

Fig. 4 Households with access to the Internet at home, 2006–2018

again to almost catch up with Poland and Hungary. Bulgaria remained at around 70%, and the other three countries touched 80%. The countries still have to evolve in HIH matters, as their average is 10% points below the EU average.

Enterprises have performed better between 2006 and 2018. More precisely, the rate of enterprises having a fixed broadband connection (EFBC) was situated between 30 and 60% in 2006, still below the 70% EU average, and it increased steadily over time, reaching 80% or more in 2018 (Fig. 5). The worst performer in terms of EFBC was Romania, but it managed to recover in 2018 and to catch up the other countries. Poland, Bulgaria and Hungary experienced an increase, with variations during the analyzed time frame. In 2018, Poland managed to reach almost 88%, while Bulgaria, Hungary and Romania just managed to exceed 80%.

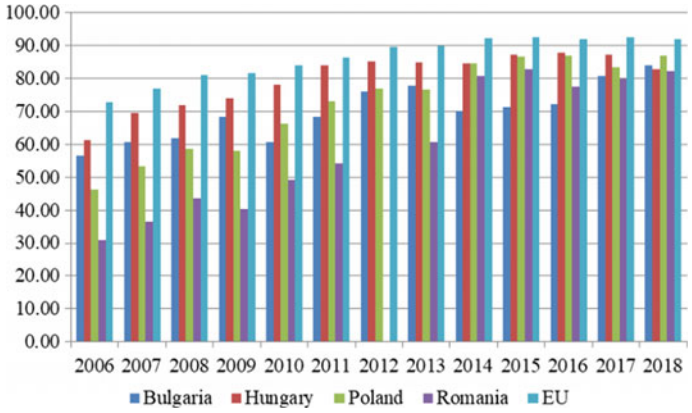

Fig. 5 Enterprises having a fixed broadband connection, 2006–2018

Although the households' internet connection rate has generally been below that of enterprises, high increases in the latter have eventually brought both categories at around the same level, i.e. 80% or more.

To conclude, although there have been large connectivity disparities between Poland and Hungary, on one hand, and Bulgaria and Romania, on the other hand, a converging trend is being noticed, all countries recently reaching similar values in such matters.

4.2 Internet Usage

In terms of Individuals who are frequent Internet users (IFIU), Hungary is the best performing country, followed by Poland, Bulgaria, and Romania (Fig. 6). The ranking has remained the same between 2006 and 2018, without any exception. However, the evolution has been a positive one, as follows: Hungary went from less than 30% to almost 70%, Poland from a bit more than 20% to about 65%, Bulgaria from 15% to around 55%, and Romania from less than 10% to more than 50%. The increase was of about 40% points for all analyzed countries. On a similar note, the EU average rose from a little more than 30% to about 75%. The countries under scrutiny have not managed to equalize the EU average so far.

Sophistication of Internet usage is depicted by the specialized web services used by individuals. One good measure of sophistication degree is Using online banking (UOB) (Fig. 7). The trend in UOB is similar to that of IFIU, but at a lower scale. Thus, the EU average is much higher than the rates of Bulgaria, Hungary, Poland, and Romania. Similarly, Romania and Bulgaria have experienced the lowest IFIU rates, with as low as 1% in 2006, to less than 10% in 2018. Poland and Hungary started from less than 10% and managed to exceed 40% in 2018. UOB reveals the

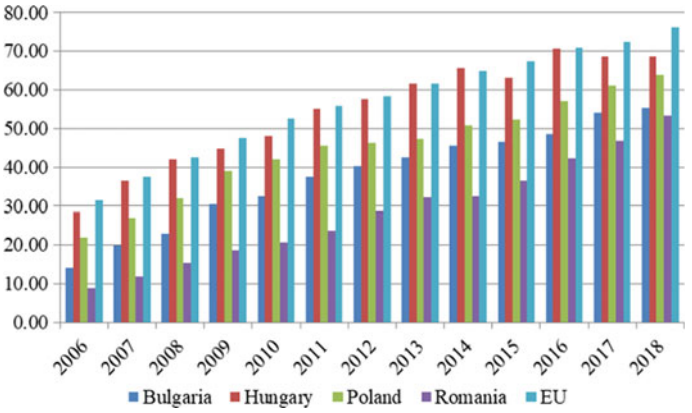

Fig. 6 Individuals who are frequent Internet users (every day or almost every day), aged 16–74, 2006–2018

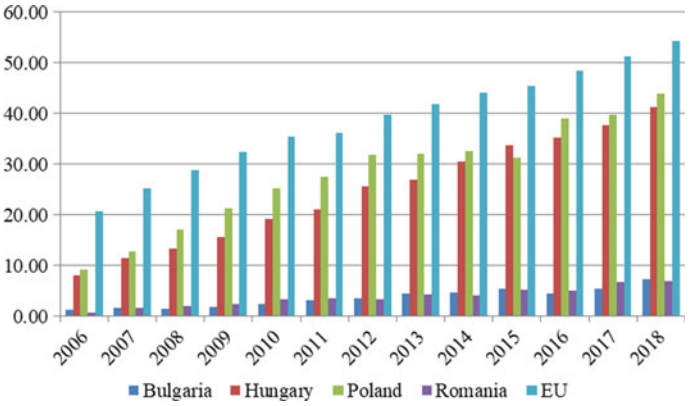

Fig. 7 Using online banking, aged 16–74, 2006–2018

largest discrepancy between the Bulgaria and Romania, on one hand, and Poland and Hungary, on the other hand. The EU average was at around 20% in 2006, and it rose to about 55% in 2018.

A noteworthy conclusion is that from a quantitative point of view, the four CEE countries managed to keep the pace with the EU average, but from a qualitative economic transactions point of view (sophistication of Internet use) there is still a large gap to fill.

Certain authors argue that the use of digital banking largely depends on the age category of the population, i.e. mobile and internet (digital) banking applications are mostly used by young generations. Therefore, the higher the proportion of young population, the higher the likelihood that new financial technologies are adopted and used (Ozden et al., 2019).

Sophistication of Internet use is also expressed by the degree to which individuals and companies use social networks. Social networks have exceeded their socialization role, and have become the stage for economic transactions, political expression, as well as a marketing tool.

In Hungary, more than half of the population uses social networks. Thus, in Hungary, Participating in social networks (PSN) was around 55% in 2013, and around 65% in 2018 (Fig. 8). These numbers are well above the EU average, which evolved from a little over 40% in 2013 to about 55% in 2018. The cohort comprising Bulgaria, Poland, and Romania experienced growth from 30 to 40% to about 50%. Romania managed to take the lead in 2018, reaching 60%, thus exceeding the EU average in an attempt to catch up with Hungary.

Unlike PSN, the rate of Enterprises using media (EUSM) for the all the four countries is below the EU average (Fig. 9). The best performer in EUSM terms is

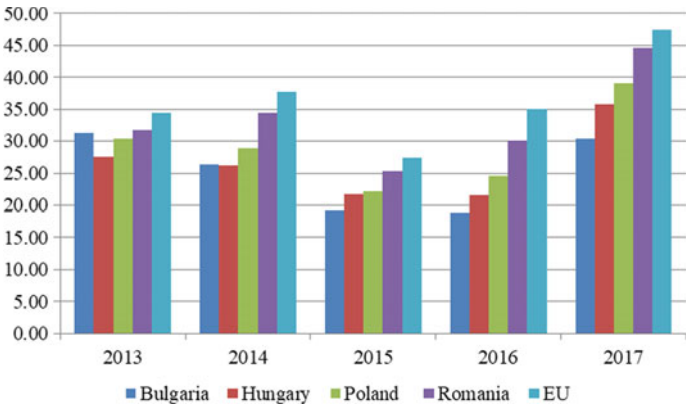

Fig. 8 Participating in social networks, over the Internet, last 3 months, aged 16–74, 2013–2018

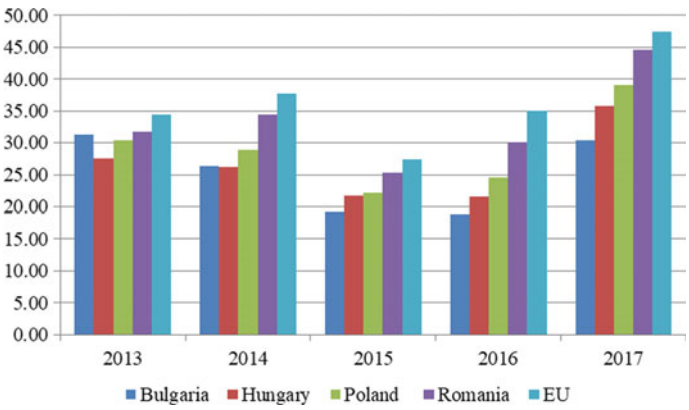

Fig. 9 Enterprises using social media, 2013–2018

Romania, starting from a little over 30% in 2013 and reaching about 45% in 2018. Surprisingly, for certain countries, there have been decreases in EUSM in some years. This is the case of all the other countries—Bulgaria, Hungary and Poland.

To sum up, there has been a steady and positive evolution in terms of use of social networks for the population, but a fluctuating evolution for businesses, with the only exception of Romania, where the trend has been positive for the entire period 2013–2018.

4.3 IT Skills

The degree of preparedness to use Internet technologies is highly dependent on the IT skills of the population. We looked into two types of data: Individuals with basic or above basic digital skills (BABDS) and Individuals who have obtained ITC skills through formal education institutions (ITCFE). The first data show the degree to which the population can perform basic ICT operations, while the second are an indicator of refined and advanced ICT skills.

In terms of BABDS, the four CEE countries perform below the EU average, which is situated at around 55% for the time frame 2015–2017 (Fig. 10). The best performing country is Hungary, at around 50%, followed by Poland, with 40–45%, and Bulgaria and Romania, with as low as 25–30%. Once again, Hungary and Poland take the lead, while Bulgaria and Romania lag behind.

In terms of ITCFE (Fig. 11), Hungary and Poland have rates of 25–30%, which are above the EU average (20–27%). Although increasing, ITCFE for Bulgaria and Romania are still below the EU average.

Data on ICT skills, both informally and formally acquired, are insufficient or discontinuous in order to have a good idea of how prepared the population is to use the existing Internet infrastructure. However, it is obvious that some countries, i.e.

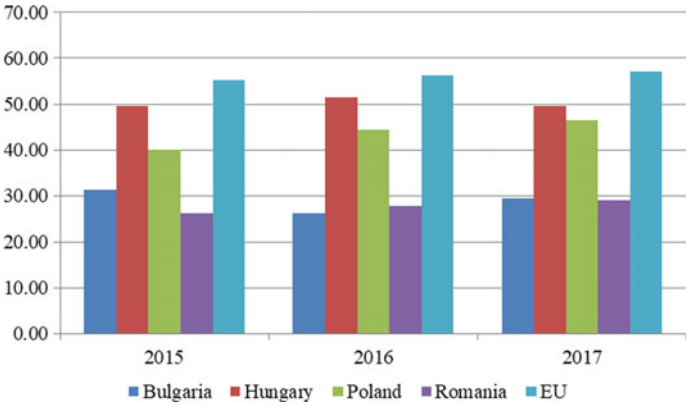

Fig. 10 Individuals with basic or above basic digital skills, aged 16–74, 2015–2017

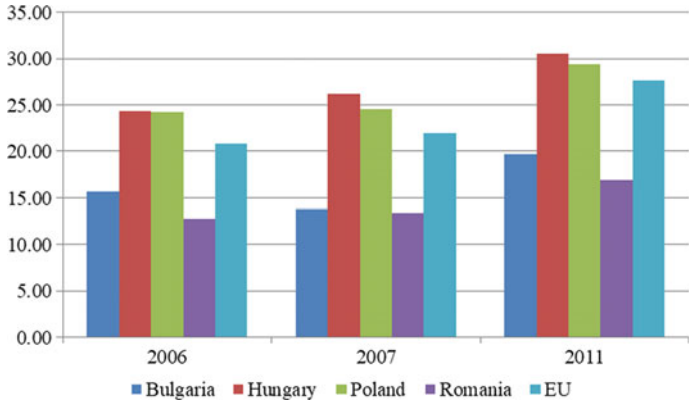

Fig. 11 Individuals who have obtained ICT skills through formal education institutions, aged 16–74, 2006, 2007, and 2011

Hungary and Poland, are better equipped with such skills than others, i.e. Bulgaria and Romania. Also, there is a large discrepancy between the Internet connection of households, on one hand, and the rate of population actually able to use it. Therefore, a valuable conclusion is that there is an underutilization of the existing Internet infrastructure due to the low rate of ICT skills.

4.4 Menaces

Technological changes come with a certain degree of resistance from the user's side, and use of Internet makes no exception. The Internet is an environment creating opportunities, but it is not risk-free one. Due to specific security vulnerabilities, individuals may experience financial losses while transacting on the Internet or they may have security concerns that deter them from using the Internet to order or purchase goods and services.

The variables Individuals experienced financial loss (IEFL) (Fig. 12) and Security concerns kept individual from ordering or buying online (SCOBO) (Fig. 13) are valuable in order to assess the menaces that hamper Internet users from extending its usage scope. However, data are reported discontinuously, for the years 2010 and 2015.

The EU average is terms of IEFL, about 2.5%, is above the analyzed countries' values, which indicates that the latter have not experienced financial losses, but in a very small percentage. The most affected country is by far Hungary, with more than 1% victims of financial losses on the Internet. IEFL for Bulgaria, Poland and Romania is at around 0.5%, which indicates a safer Internet environment from a transaction point of view.

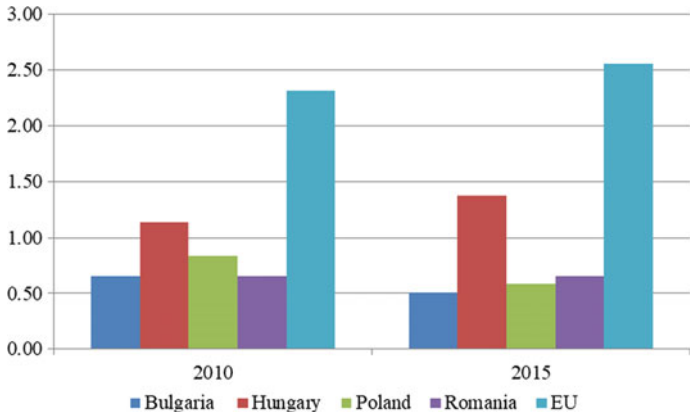

Fig. 12 Individuals experienced financial loss, aged 16–74, 2010 and 2015

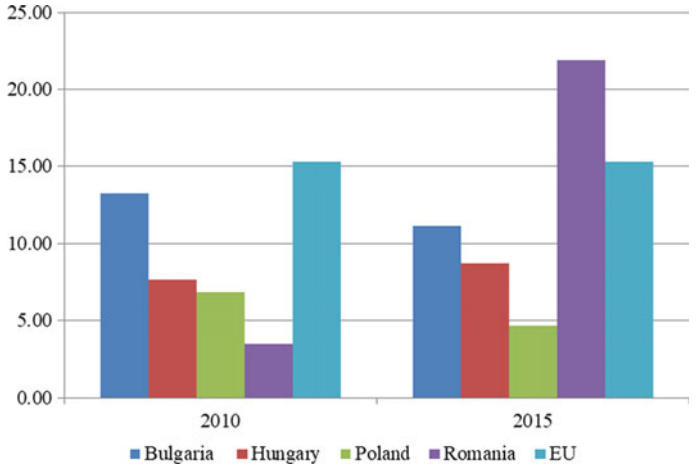

Fig. 13 Security concerns kept individual from ordering or buying online, aged 16–74, 2010 and 2015

In the EU, security concerns about ordering and purchasing online is at 15%. Skepticism in this respect has grown significantly in Romania, from about 4% to more than 20%. Such a resistant attitude could be a deterrent for using the Internet for more than information and communication, including crowdfunding. However, security concerns have dropped in Bulgaria, Hungary, and Poland, which translates into a more favorable environment for crowdfunding and other Internet-based technologies involving online payments and transactions.

The general conclusion of this analysis is that the Internet infrastructure has developed and it is ahead of IT skills, which render it underutilized. Despite a generalized

increase in the number of users, both individuals and enterprises, the degree of sophistication in terms of Internet usage is still below average in the analyzed countries. To this is added a certain degree of circumspection in using the Internet for transactions. In other words, although households and populations are better equipped from a technological point of view, they are still lagging behind in terms of skills and openness to extend Internet usage. These shortcomings that also affect crowdfunding development can be dealt with through better education, reinforcement of security over the Internet along with better promotion of new web-based technologies.

5 An Overview of Crowdfunding Regulations

This section will briefly present the main types and regulations regarding crowdfunding in the four analyzed countries. Regulations are one of the three pillars proposed in reference (Jenik et al., 2017).

5.1 Bulgaria

The lending-based crowdfunding model is represented by four main platforms: (1) Iuvo, which managed to raise BGN 420,000 during 2016–2017, with an yield rate between 5 and 12%; (2) Klear—borrowers pay an annual percentage rate of about 6% as compared to an average of 11% for bank loans; profitability is expected to be at around 6%; (3) Mintos, with an yield rate between 5.5 and 15%. The platform managed to grant loans amounting to EUR 73 million; (4) Twino, on which EUR 60 million have been invested, with a return of more than EUR 850,000 paid to investors. The average yield rate is 11% (ECN, 2017).

In Bulgaria, the donations or reward model has been used for the formation of human capital abroad. Scholarships were granted in order for students to complete quality education in prestigious universities under the condition of returning to the country to provide skills and capabilities. In 2016, donations reached BGN 11,000 (ECN, 2017).

The first platform for shared financing of real estate in Southeast Europe was launched in Bulgaria, and it was based on cooperation between operators who select and prepare projects for shared funding, investors who finance projects, and project managers (ECN, 2017).

Bulgaria has also experienced the renewable energy sources crowdfunding model. The program is meant to promote the use of renewable energy in towns and private buildings, given the rising cost of electricity. The anticipated outcome is decreasing costs financed by public budgets, while generating savings that can be redirected to other areas of public interest (ECN, 2017).

In Bulgaria, there are no specific crowdfunding regulations. Platform operators may have to be licensed or registered as financial or credit institutions by the Bulgarian

National Bank. As for the foreign crowdfunding platforms addressing Bulgarian investors having a foreign MiFID (Markets in Financial Instruments Directive) license, they are allowed to operate without any other additional license. However, if the platform owner does not have such a license, it has to obtain one locally. Another requirement is for foreign crowdfunding platforms addressing Bulgarian companies to be listed in the Register of Public Companies and Other Issuers of Securities. Bulgarian crowdfunding issuers do not have to register in foreign countries. The threshold is EUR 100,000 per issuer within 12 months (ECN, 2017).

5.2 Hungary

The lending-based crowdfunding model, the real estate crowdfunding model, and the renewable energy sources crowdfunding model are not present in Hungary. The only crowdfunding models are donation and reward-based. However, recent years have not brought much change in this field. The reduced number of platforms only collects limited amounts of funds (ECN, 2017).

In Hungary, crowdfunding platforms may be subject of regulation if they facilitate the offering of securities or if they facilitate/intermediate the granting of loans to crowdfunded businesses. However, crowdfunding activity may be designed so as to avoid or limit license requirements. The Hungarian threshold is the same as the one in Bulgaria, i.e. EUR 100,000 over a period of 12 months (ECN, 2017). Other than that, there are no other regulatory barriers.

5.3 Poland

In Poland, all types of crowdfunding models are present. As concerns the equity model, many such platforms are active (e.g. CrowdAngels, GetFunded, Beesfund, FindFunds, etc.). Also, there is an increasing number of lending-based crowdfunding platforms. As in Bulgaria and Hungary, donation-based and reward-based crowdfunding models are the most numerous and developed. They are recipients of the larger crowdfunding projects. Real estate crowdfunding has also emerged in Poland, with new entrants and developing platforms as well. The least developed area is that of renewable energy crowdfunding model. Projects in this area are small, but they managed to finance ten wind power plants in 2017 (ECN, 2017).

As no specific crowdfunding regulations exist, the Polish Civil Code applies, and other related acts. The absence of regulation is a barrier for the development of crowdfunding, but it also creates speculative behavior in order to avoid certain regulatory barriers (e.g. prospectus thresholds). Crowdfunding platforms can be either joint-stock companies or limited liability companies. In the second case, there are several legal procedures to be fulfilled (a minimum value of PLN 50 per share and

sales contract authenticated by a notary public). EU-registered platforms can provide services and use the MiFID license in Poland (ECN, 2017).

5.4 Romania

Some of the crowdfunding models are not present in Romania. This is the case of lending-based, real estate, and renewable energy crowdfunding models. Equity-based crowdfunding platforms are in an early stage of development, the most important being Multifinantare, AngelConnect, and TechAngels. The most prominent types of crowdfunding are donation and reward-based (ECN, 2017).

As in the case of Bulgaria, Hungary and Poland, Romania does not have specific crowdfunding legislation. Thus, public offering of securities and trading shares of a company on regulated markets are subject to regulations enforced by specialized agencies. MiFID licenses can be used with a prior notification procedure. For companies, the prospectus regulation applies. Foreign crowdfunding platforms need to comply with the regulations of the country of origin (ECN, 2017).

6 A Brief Look into the Traditional Funding Tools

We now analyze the traditional financing tools in order to see how FinTech and AltFi address uncovered needs and how they can fit into the respective markets.

In order to understand the crowdfunding phenomenon, we need to analyze the financial context in which financing initiatives can merge and develop. To this purpose we present the data on Lending Interest Rates (LIR) and Deposit Interest Rates (DIR). The two can explain the alternatives that businesses have when they need to finance their activities outside the banking system. They also show what the lenders' possibilities are to place savings, for instance on crowdfunding platforms or bank deposits. In addition, to better describe the financial context, we included data regarding the degree of sophistication of the stock market using IMF's Financial Market Efficiency Index (FMEI) of the. The latter could explain the alternative option of those who save to place their money on stock markets. Figure 14 presents LIR.

As can be noticed, Romania and Bulgaria had the highest LIR over the entire analyzed period. Although interest rates fell after the economic crisis, they remained the highest among the analyzed countries. On the contrary, Hungary benefited from very low LIR even during the economic crisis. In this context, we would expect AltFi to appear and develop mainly in Bulgaria and Romania, offering rapid and cheaper financing solutions to business projects. This hypothesis is confirmed for Bulgaria, where lending-based crowdfunding platforms exist, but not for Romania.

A possible explanation could be the inexistence of specific regulations to clarify the institutional framework for lending-based crowdfunding model. However, would-be creditors would rather be attracted by the opportunities provided by stock markets.

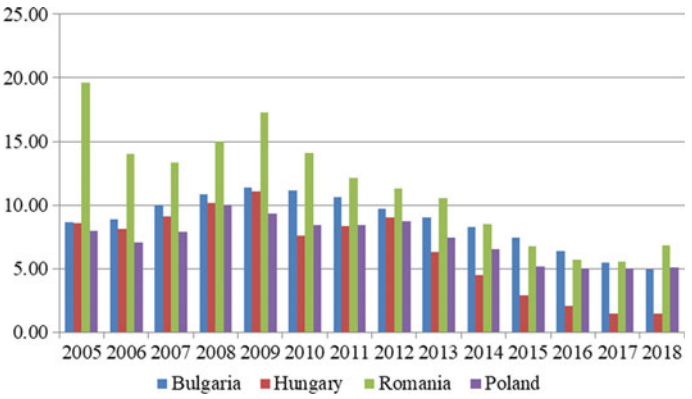

Fig. 14 Lending interest rate, percent per annum, 2005–2018

FMEI (0–1 best), which compiles data regarding stock market turnover ratio, shows a higher degree of sophistication for the Romanian market than for the Bulgarian one (Fig. 15). This could mean that stock market investments in Romania are more attractive than those in Bulgaria. Also, there is an increasing number of equity-based crowdfunding platforms in Romania.

This hypothesis seems to be valid for Hungary. LIR is very low, which provides relatively cheaper financing opportunities through the banking system. On top of this, the stock market in Hungary is the most developed one among the four countries under investigation. These two remarks can explain the lack of lending-based crowdfunding initiatives despite the not-very-burdensome regulations regarding crowdfunding activities.

In Poland, we can notice that crowdfunding is a real financing alternative to bank loans. LIR are relatively high, which can further explain the growing market both of peer-to-peer lending (lending-based crowdfunding model) and of the real estate

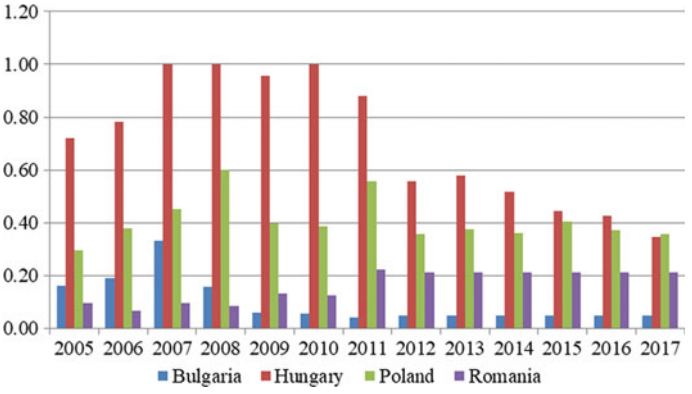

Fig. 15 Financial market efficiency index, 2005–2017

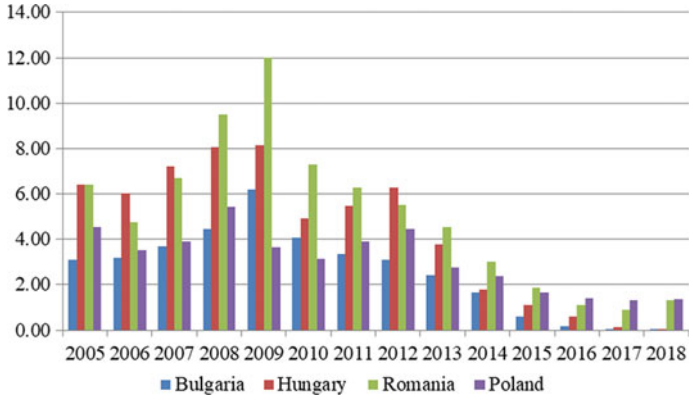

Fig. 16 Deposit interest rate, percent per annum, 2005–2017

crowdfunding model. FMEI has relatively high values, which can be also explained by the increasing number of equity-based crowdfunding platforms.

Analyzing DIR, it is obvious that their values dropped for all analyzed countries, particularly after the year 2014 (Fig. 16). This means that banks can obtain relatively cheap financing sources for loans, which renders them more attractive as compared to the alternative, i.e. crowdfunding, especially in Hungary. Also, such low interest rates create opportunities for those who have savings as they can choose alternative investments. This can represent an opportunity for crowdfunding, as such initiatives could offer higher yield rates.

7 Well-Being and Crowdfunding Development

The structure and volume of crowdfunding transactions are mainly determined by the regulatory framework, but not exclusively. Taking part in crowdfunding initiatives is the outcome of institutional arrangements in the selected countries, but of other factors too, such as the efficiency of traditional financing systems. In the latter case, we could find explanations for the different stages of development of certain crowdfunding models. However, as it was showed earlier, the crowdfunding transactions in the analyzed countries are mainly for donation and reward-based models. Drawing from these observations, we address the following research question: even in the absence of specific institutional arrangements, which are aimed at regulating crowdfunding transactions, how can we explain the developments of donation and reward-based models in these countries? Irrespective of the regulatory frame, there have to exist financing sources for crowdfunding transactions, especially in the specific case of these models. Consequently, a certain level of well-being could influence the availability to finance such projects. This hypothesis creates the opportunity for a

Table 1 Well-being selected indicators

	Educational attainment				Mean equivalized net income (PPS)				Employment and activity			
	BG	HU	PL	RO	BG	HU	PL	RO	BG	HU	PL	RO
2007	77.4	79	86.3	75	3,824	7,196	6,652	3,367	68.4	62.3	62.7	64.4
2008	77.5	79.6	87.1	75.3	5,855	7,237	8,013	3,640	70.7	61.5	65.0	64.4
2009	77.9	80.5	88	74.7	6,669	7,502	8,668	4,004	68.8	60.1	64.9	63.5
2010	79.1	81.2	88.5	73.9	6,824	7,324	8,800	4,121	64.7	59.9	64.3	64.8
2011	80	81.5	88.9	74.5	6,861	8,026	9,645	4,182	62.9	60.4	64.5	63.8
2012	81	82	89.6	75.4	6,527	8,500	10,079	4,263	63.0	61.6	64.7	64.8
2013	81.8	82.5	90.1	75.7	7,080	8,222	10,615	4,487	63.5	63.0	64.9	64.7
2014	81.1	83.1	90.5	72.8	7,977	8,583	11,057	4,555	65.1	66.7	66.5	65.7
2015	81.9	83.2	90.8	75	8,454	8,987	11,450	5,036	67.1	68.9	67.8	66.0
2016	82.3	83.4	91.3	76.7	8,248	9,359	12,327	5,302	67.7	71.5	69.3	66.3
2017	82.8	84	92.1	77.9	9,641	9,319	12,721	5,915	71.3	73.3	70.9	68.8
2018	82.6	84.9	92.4	78.5	9,364	9,769	13,029	7,269	72.4	74.4	72.2	69.9

Source Eurostat (2019a, b, c)

Note The data used have break in time series for all selected countries, with the exception of Hungary, in 2010, and for all the selected countries in 2014

subsequent research question: can well-being explain the particular developments of crowdfunding models in the selected countries?

In order to answer these questions, we used selected data to express the level of well-being and its influence on crowdfunding transactions, as was explained in the Materials and Methods section. The selected data are: at least upper secondary educational attainment, age 25–64 years, employment and activity, percentage of total population, age 20–64 years.

As can be noticed from Table 1, educational attainment, at least upper secondary level, rose in all selected countries. The increase in educational attainment, at least upper secondary level, for all selected countries, during the entire time frame considered, creates the premises for an increase in digital skills, which are necessary for using ICT to be part of crowdfunding transactions. The best performing countries are Poland and Hungary, while the lowest levels of educational attainment are in Bulgaria and Romania. These observations are confirmed by the level of IT skills in the selected countries, as can be noticed in Fig. 11. Thus, at least for the years 2007 and 2011, we can notice a correlation between digital skills obtained through formal education and educational attainment. Moreover, the same hierarchy of performances in terms of educational attainment level is to be preserved in the case of individuals with basic or above basic digital skills, aged 16–74 for the period 2015–2017 (Fig. 10). Therefore, the hypothesis according to which digital skills, be them the result of formal education or not, are influenced by the educational attainment level, seems to be confirmed despite the insufficient or discontinuous data regarding digital skills.

Mean equivalized net income followed an ascending trend in all selected countries. The highest values are reached in Poland, whereas in Romania mean equivalized net income has the lowest levels. In terms of mean equivalized net income in Bulgaria during the period 2012–2017, we can notice a steady increase, which could explain the high degree of diversification of crowdfunding transactions in this country. The increase in mean equivalized net income reflects a positive evolution of well-being in the selected countries, despite their obvious differences.

As concerns employment and activity, we can notice that, starting from 2011, all selected countries experience increasing values. Hungary stands out as the country with the highest increases. Romania, on the other hand, has the lowest rates of increase of employment.

To conclude, the indicators selected in order to highlight the level of well-being have an upward trend for the analyzed period for all selected countries. This confirms the existence of a favorable context for the development of crowdfunding transactions given that the level of well-being is increasing. The increase in educational attainment can explain the use of IT skills in crowdfunding transactions, but also the increasing openness towards this phenomenon. At the same time, wealthier countries, due to the increase in income and employment, could explain the existence of financial resources to allocate for crowdfunding projects.

8 Discussion and Conclusions

All things considered, crowdfunding in the four analyzed countries has the potential to grow, mostly from a technological perspective. Thus, the penetration rate of Internet in Bulgaria, Hungary, Poland, and Romania tends to converge with the European rate. In spite of the expanding infrastructure, Internet usage has not yet reached the European level of sophistication, as use of social media and online payments both by individuals and by companies, is still relatively low. On the other hand, basic IT skills are still low compared to the European average. However, the number of formally qualified individuals in IT skills in Hungary and Poland is higher than the EU average. Last but not least, the four countries have faced online financial losses that are well below the EU average, and skepticism concerning online security is generally lower than the EU average. Therefore, connectivity and relatively low menaces are the strengths of the four countries, while internet usage and IT skills remain the main weaknesses.

Although it is not a shortcoming just for the analyzed countries, lack of regulations in terms of crowdfunding remains the main cause of crowdfunding market underdevelopment. Whereas crowdfunding has flourished in countries having enacted specific regulations, such as Great Britain, Italy, France, US, there is still a long way for this AltFi to gain ground in Central and Eastern Europe.

The economic environment is also an enabler or a deterrent of crowdfunding, depending on the country. Countries having relatively cheap financing alternatives

on the traditional financial market will not experience an accelerated growth of crowdfunding. Lending interest rates in Romania and Bulgaria are relatively higher, therefore crowdfunding could represent a viable alternative; however, its growth cannot happen without proper regulations for equity-based and lending-based crowdfunding. In Hungary, interest rates are relatively lower, which makes crowdfunding less attractive. Poland, of all the four countries, has seen crowdfunding as a viable alternative to traditional financing, and the size of the market is, as a consequence, the biggest.

Despite the limitations stemming from an inexistent institutional frame, the crowdfunding growth and development in the analyzed countries is the result of an increase in well-being, particularly in educational attainment, income and wealth and jobs and earnings components. In the absence of a regulatory frame, the well-being level contributes to the development of reward-based and donation-based models in the selected countries. This is because it implies a lower level of risk, being mainly dependent on the financial resources the population is willing and able to donate or spend. A certain level of well-being could, therefore, also explain the crowdfunding transactions development as is the case of Poland. Having the best performances for two out of the three selected well-being data, Poland has the biggest crowdfunding market size as well.

Based on the research we consider that it is high time to enact crowdfunding in all four countries. Without proper legislation, skepticism and lack of awareness could remain at a high level, and the phenomenon would be limited to its less developed forms, i.e. reward-based and donation-based. Other measures would be the strengthening of online security and stimulation of Internet sophistication, which could range from a higher rate of online payments, use of social media to online investments, and online loans.

Crowdfunding creates opportunities on multiple levels. The first level is the personal one, which refers to increased and more inclusive access to finance. This results in an increased level of citizens' standard of living and well-being, especially because numerous crowdfunding campaigns have a prosocial or humanitarian character. The second level is the financial market one. From this perspective, the advent and development of this smart finance tool diminishes transaction costs and time related to financing, and smart finance tools become viable alternatives to traditional financing. Such developments ultimately lead to a more competitive financing market, with benefits for citizens and entrepreneurs alike. The third level is that of the city and local community. Crowdfunding may also finance local development projects, in addition to existing public or private insufficient funds. Because crowdfunding success rate is higher in urban areas, this tool can become a driver of smart city development if better explained, promoted and regulated.

The main research limitation consists in lack of consistent data regarding the size of the crowdfunding market in the four analyzed countries. Thus, research in crowdfunding in particular, and in AltFi and FinTech in general, needs to be extended, with the aim of proposing useful customized measures and policies for each specific country. The gap in the development of the AltFi market between Central and Eastern Europe and Western Europe could be filled once European policies are put in place to stimulate cross-border financing via crowdfunding and other AltFi.

References

Alderete, M. V. (2017). The age of prosumerism: Some micro-economic analysis. *Journal of Theoretical and Applied Electronic Commerce Research, 12*(3), 1–12. https://doi.org/10.4067/S0718-18762017000300002

Borst, I., Moser, C., & Ferguson, J. (2018). From friendfunding to crowdfunding: Relevance of Relationships, social media, and platform activities to crowdfunding performance. *New Media & Society, 20*(4), 1396–1414. https://doi.org/10.1177/1461444817694599

Brent, D. A., & Lorah, K. (2019). The economic geography of civic crowdfunding. *Cities, 90*, 122–130. https://doi.org/10.1016/j.cities.2019.01.036

Burtch, G., Ghose, A., & Wattal, S. (2015). The hidden cost of accommodating crowdfunder privacy preferences: A randomized field experiment. *Management Science, 61*(5), 949–962. https://doi.org/10.1287/mnsc.2014.2069

Burtch, G., Ghose, A., & Wattal, S. (2016). Secret admirers: An empirical examination of information hiding and contribution dynamics in online crowdfunding. *Information Systems Research, 27*(3), 478–496. https://doi.org/10.1287/isre.2016.0642

Busse, V. (2018). Crowdfunding—An empirical study on the entrepreneurial viewpoint. In F. Xhafa, L. Barolli, & M. Gregus (Eds.), *Advances in Intelligent Networking and Collaborative Systems: The 10th International Conference on Intelligent Networking and Collaborative Systems (INCoS-2018)* (pp. 306–318). Bratislava.

Care, S., Trotta, A., Care, R., & Rizzello, A. (2018). Crowdfunding for the development of smart cities. *Business Horizons, 61*(4), 501–509. https://doi.org/10.1016/j.bushor.2017.12.001

Cicchiello, A. F., Battaglia, F., & Monferra, S. (2019). Crowdfunding tax incentives in Europe: A comparative analysis. *European Journal of Finance*. https://doi.org/10.1080/1351847X.2019.1610783

Dai, H., Yin, J. L., Wang, K., Tsai, S. B., Zhou, B. W., & Lin, W. P. (2018). Trust building in dynamic process of internet entrepreneurial social network. *IEEE Access, 6*, 79138–79150. https://doi.org/10.1109/ACCESS.2018.2883755

Davies, W. E., & Giovannetti, E. (2018). Signalling experience & reciprocity to temper asymmetric information in crowdfunding evidence from 10,000 projects. *Technological Forecasting and Social Change, 133*, 118–131. https://doi.org/10.1016/j.techfore.2018.03.011

Eiteneyer, N., Bendig, D., & Brettel, M. (2019). Social capital and the digital crowd: Involving backers to promote new product innovativeness. *Research Policy, 48*(8). https://doi.org/10.1016/j.respol.2019.01.017

European Commission. (2016). *Crowdfunding in the EU capital markets Union*. Retrieved October 31, 2019, from https://ec.europa.eu/info/publications/crowdfunding-eu-capital-markets-union_en

European Commission. (2017). *Identifying market and regulatory obstacles to cross-border development of crowdfunding in the EU*. Retrieved October 31, 2019, from https://ec.europa.eu/info/publications/171216-crowdfunding-regulatory-obstacles-crossborder-development_en

European Commission. (2019a). *The digital economy and society index (DESI)*. DESI 2019. Retrieved October 31, 2019, from https://ec.europa.eu/digital-single-market/en/desi

European Commission. (2019b). *Digital single market. Digital scoreboard. Visualisations. Digital agenda scoreboard key indicators*. Retrieved October 31, 2019, from https://digital-agenda-data.eu/datasets/digital_agenda_scoreboard_key_indicators/visualizations

European Commission. *Crowdfunding*. Retrieved October 31, 2019, from https://ec.europa.eu/info/business-economy-euro/growth-and-investment/financing-investment/crowdfunding_en

European Crowdfunding Network. (2017). *Review of Crowdfunding Regulation 2017. Interpretations of existing regulation concerning crowdfunding in Europe, North America and Israel*. Brussels, Belgium, 2017. Retrieved from European Crowdfunding Network website https://eurocrowd.org/wp-content/blogs.dir/sites/85/2017/10/ECN_Review_of_Crowdfunding_Regulation_2017.pdf

Eurostat. (2019a). *Mean and median income by household type—EU-SILC and ECHP surveys*. Retrieved October 31, 2019, from http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ilc_di04

Eurostat. (2019b). *Employment and activity by sex and age—Annual data*. Retrieved October 31, 2019, from https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsi_emp_a&lang=en

Eurostat. (2019c). *At least upper secondary educational attainment, age group 25–64 by sex*. Retrieved October 31, 2019, from https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tps00065&plugin=1

Fanea-Ivanovici, M. (2019). *Crowdfunding—Metodă inovativă de finanţare pentru industriile creativ-culturale*. Editura ASE.

Feller, J., Gleasure, R., & Treacy, S. (2017). Information sharing and user behavior in internet-enabled peer-to-peer lending systems: An empirical study. *Journal of Information Technology, 32*(2), 127–146. https://doi.org/10.1057/jit.2016.1

Gallemore, C., Nielsen, K. R., & Jespersen, K. (2019). The uneven geography of crowdfunding success: Spatial capital on Indiegogo. *Environment and Planning A, 51*(6), 1389–1406. https://doi.org/10.1177/0308518X1984392

Gleasure, R., & Morgan, L. (2018). The pastoral crowd: Exploring self-hosted crowdfunding using activity theory and social capital. *Information Systems Journal, 28*(3), 489–515. https://doi.org/10.1111/isj.12143

Gleasure, R., O'Reilly, P., & Cahalane, M. (2017). Inclusive technologies, selective traditions: A socio-material case study of crowdfunded book publishing. *Journal of Information Technology, 32*(4), 326–343. https://doi.org/10.1057/s41265-017-0041-y

Gleasure, R., Conboy, K., & Morgan, L. (2019). Talking up a storm: How backers use public discourse to exert control in crowdfunded systems development projects. *Information Systems Research, 30*(2), 447–465. https://doi.org/10.1287/isre.2019.0840

Hong, Y. L., Hu, Y. H., & Burtch, G. (2018). Embeddedness, prosociality, and social influence: Evidence from online crowdfunding. *MIS Quarterly, 42*(4), 1211–+. https://doi.org/10.25300/MISQ/2018/14105

Hornuf, L., & Schwienbache, A. (2017). Should securities regulation promote equity crowdfunding. *Small Business Economics, 49*(3), 579–593. https://doi.org/10.1007/s11187-017-9839-9

International Monetary Fund. (2019a). *IMF policy paper. FinTech: The experience so far*. Retrieved October 31, 2019, from https://www.imf.org/en/Publications/Policy-Papers/Issues/2019/06/27/Fintech-The-Experience-So-Far-47056

International Monetary Fund. (2019b). *Interest rates selected indicators. Financial, interest rates, monetary policy-related interest rate, percent per annum*. Retrieved October 31, 2019, from http://data.imf.org/regular.aspx?key=61545867

International Monetary Fund. (2019c). *Financial development. Financial institutions efficiency index. Financial markets efficiency index*. Retrieved October 31, 2019, from https://data.imf.org/?sk=F8032E80-B36C-43B1-AC26-493C5B1CD33B&sId=1481126573525

Jenik, I., Lyman, T., & Nava, A. (2017). *Crowdfunding and financial inclusion*. Retrieved from https://www.cgap.org/sites/default/files/Working-Paper-Crowdfunding-and-Financial-Inclusion-Mar-2017.pdf

Kang, L. L., Jiang, Q. Q., & Tan, C. H. (2017). Remarkable advocates: An investigation of geographic distance and social capital for crowdfunding. *Information & Management, 54*(3), 336–348. https://doi.org/10.1016/j.im.2016.09.001

Kindler, A., Golosovski, M., & Solomon, S. (2019). Early prediction of the outcome of kickstarter campaigns: Is the success due to virality. *Palgrave Communications, 5*. https://doi.org/10.1057/s41599-019-0261-6

Kromidha, E., & Robson, P. (2016). Social identity and signalling success factors in online crowdfunding. *Entrepreneurship and Regional Development, 28*(9–10), 605–629. https://doi.org/10.1080/08985626.2016.1198425

Lagazio, C., & Querci, F. (2018). Exploring the multi-sided nature of crowdfunding campaign success. *Journal of Business Research, 90*, 318–324. https://doi.org/10.1016/j.jbusres.2018.05.031

Laurell, C., Sandstorm, C., & Suseno, Y. (2019). Assessing the interplay between crowdfunding and sustainability in social media. *Technological Forecasting and Social Change, 141*, 117–127. https://doi.org/10.1016/j.techfore.2018.07.015

Liu, L. L., Suh, A., & Wagner, C. (2019). Empathy or perceived credibility? An empirical study on individual donation behaviour in charitable crowdfunding. *Internet Research, 28*(3), 623–651. https://doi.org/10.1108/IntR-06-2017-0240

Lytras, M. D., & Visvizi, A. (2019). Big data and their social impact: Preliminary study. *Sustainability, 11*(18), 1–18. https://doi.org/10.3390/su11185067

Lytras, M., & Visvizi, A. (2020). Information management as a dual-purpose process in the smart city: Collecting, managing and utilizing information. *International Journal of Information Management*, 102224. https://doi.org/10.1016/j.ijinfomgt.2020.102224

Lytras, M., Visvizi, A., Chopdar, P., Sarirete, A., & Alhalabi, W. (2020). Information management in smart cities: Turning end users' views into multi-item scale development, validation, and policy-making recommendations. *International Journal of Information Management*, 102146. https://doi.org/10.1016/j.ijinfomgt.2020.102146

Madrazo-Lamarroy, P., Barajas-Portas, K., & Tovar, M. E. L. (2019). Analyzing campaign's outcome in reward-based crowdfunding. Social capital as a determinant factor. *Internet Research, 29*(5), 1171–1189. https://doi.org/10.1108/INTR-03-2018-0115

Mendoza-Tello, J. C., Mora, H., Pujol-López, F. A., & Lytras, M. D. (2018). Social commerce as a driver to enhance trust and intention to use cryptocurrencies for electronic payments. *IEEE Access, 6*, 50737–50751. https://doi.org/10.1109/ACCESS.2018.2869359

Mendoza-Tello, J. C., Mora, H., Pujol-López, F. A., & Lytras, M. D. (2019). Disruptive innovation of cryptocurrencies in consumer acceptance and trust. *Information Systems and E-Business Management, 17*(2–4), 195–222. https://doi.org/10.1007/s10257-019-00415-w

Morschheuser, B., Hamari, J., & Maedche, A. (2019). Cooperation or competition–when do people contribute more? A field experiment on gamification of crowdsourcing. *International Journal of Human-Computer Studies, 127*(SI), 7–24. https://doi.org/10.1016/j.ijhcs.2018.10.001

Narodowy Bank Polski. (2019). *Statistics. Monetary and financial statistics. Interest rate statistics.* Retrieved October 31, 2019, from https://www.nbp.pl/homen.aspx?f=/en/statystyka/oproc/oproc.html

Omarova, S. T. (2019). New tech v. new deal: Fintech as a systemic phenomenon. *Yale Journal on Regulation, 36*(2), 735–793. https://www.yalejreg.com/print/page/2/

Organisation for Economic Co-operation and Development. (2019a). *The economy of well-being. Creating opportunities for people's well-being and economic growth.* Retrieved October 31, 2019, from https://www.oecd-ilibrary.org/docserver/498e9bc7-en.pdf?expires=1576750178&id=id&accname=guest&checksum=B0193C71D48ECC56E39825E138AECD52

Organisation for Economic Co-operation and Development. (2019b). *Better life index.* Retrieved October 31, 2019, from https://stats.oecd.org/Index.aspx?DataSetCode=BLI

Ozden, U., Adil Sepici, A., & Karadağ, B. (2019). Increasing the use of digital banking applications for the baby boomer generation by easy interface. In O. Findik, E. Sonuc, & Y. Y. Baydilli (Eds.), *Proceeding Book of the International Conference on Advanced Technologies, Computer Engineering and Science (ICATCES 2019)* (pp. 219–222). Alanya.

Paredes, H., Barrosso, J., & Bigham, J. P. (2018). All (of us) can help: Inclusive crowdfunding research trends and future challenges. In W. Shen, J. Luo, J. P. Barthès, F. Dong, J. Zhang, & H. Zhu (Eds.), *Proceedings of the IEEE 22nd International Conference on CSCWD*. Nanjing, China. https://ieeexplore.ieee.org/xpl/conhome/8455506/proceeding

Planells, A. J. (2017). Video games and the crowdfunding ideology: From the gamer-buyer to the prosumer-investor. *Journal of Consumer Culture, 17*(3), 620–638. https://doi.org/10.1177/1469540515611200

Ritzer, G. (2015). The 'new' world of prosumption: Evolution, 'return of the same', or revolution. *Sociological Forum, 30*(1), 1–17. https://doi.org/10.1111/socf.12142

Ritzer, G., & Jurgenson, N. (2010). Production, consumption, prosumption. The nature of capitalism in the age of the digital 'prosumer'. *Journal of Consumer Culture, 10*(1), 13–36. https://doi.org/10.1177/1469540509354673

Saxton, G. D., & Wang, L. L. (2014). The social network effect: The determinants of giving through social media. *Nonprofit and Voluntary Sector Quarterly, 43*(5), 850–868. https://doi.org/10.1177/0899764013485159

Siuda, P., & Troszynski, M. (2017). Natives and tourists of prosumer capitalism: On the varied pro-prosumer activities of producers exemplified in the polish pop culture industry. *International Journal of Cultural Studies, 20*(5), 545–563. https://doi.org/10.1177/1367877916666117

Soon, J. M., & Saguy, I. S. (2017). Crowdsourcing: A new conceptual view for food safety and quality. *Trends in Food Science & Technology, 66*, 63–72. https://doi.org/10.1016/j.tifs.2017.05.013

Stemler, A. R. (2013). The JOBS act and crowdfunding: Harnessing the power- and money-of the masses. *Business Horizons, 56*(3), 271–275. https://doi.org/10.1016/j.bushor.2013.01.007

Torres-Ruiz, M. J., & Lytras, M. D. (2019). Urban computing and smart cities applications for the knowledge society. *International Journal of Knowledge Society Research, 7*(1), 113–119. https://doi.org/10.4018/IJKSR.2016010108

Vealey, K. P., & Gerding, J. M. (2016). Rhetorical work in crowd-based entrepreneurship: Lessons learned from teaching crowdfunding as an emerging site of professional and technical communication. *IEEE Transactions on Professional Communication, 59*(4), 407–427. https://doi.org/10.1109/TPC.2016.2614742

de la Vina, L. Y., & Black, S. L. (2018). US equity crowdfunding: A review of current legislation and a conceptual model of the implications for equity funding. *Journal of Entrepreneurship, 27*(1), 83–110. https://doi.org/10.1177/0971355717738600

Vismara, S. (2016). Equity retention and social network theory in equity crowdfunding. *Small Business Economics, 46*(4), 579–590. https://doi.org/10.1007/s11187-016-9710-4

Vismara, S. (2018). Information cascades among investors in equity crowdfunding. *Entrepreneurship Theory and Practice, 42*(3), 467–497. https://doi.org/10.1111/etap.12261

Visvizi, A., Mazzucelli, C. G., & Lytras, M. (2017). Irregular migratory flows: Towards an ICTs' enabled integrated framework for resilient urban systems. *Journal of Science and Technology Policy Management, 8*(2), 227–242. https://doi.org/10.1108/JSTPM-05-2017-0020

Visvizi, A., Lytras, M. D., Damiani, E., & Mathkour, H. (2018). Policy making for smart cities: Innovation and social inclusive economic growth for sustainability. *Journal of Science and Technology Policy Management, 9*(2), 126–133. https://doi.org/10.1108/JSTPM-07-2018-079

Wang, Z. Y., Liu, Y. Q., Tsai, S. B., Fei, S. Q., Hsu, C. F., He, H. D., & Shi, Y. F. (2019). A research on effect of response to internet financing reputation evaluation on achievement—From the perspective of social network theory. *IEEE Access, 7*, 39352–39361. https://doi.org/10.1109/ACCESS.2019.2903681

Wessel, M., Thies, F., & Benlian, A. (2017). Opening the floodgates: The implications of increasing platform openness in crowdfunding. *Journal of Information Technology, 32*(4), 344–360. https://doi.org/10.1057/s41265-017-0040-z

World Urban Campaign. Retrieved October 31, 2019, from https://www.worldurbancampaign.org/civic-crowdfunding-collective-option-urban-sustainable-development

Yang, D., Chen, P., Shi, F. Y., & Wen, G. C. (2018). Internet finance: Its uncertain legal foundations and the role of big data in its development. *Emerging Markets Finance and Trade, 54*(4), 721–732. https://doi.org/10.1080/1540496X.2016.1278528

Yang, Y., Wang, H. J., & Wang, G. (2016). Understanding crowdfunding processes: A dynamic evaluation and simulation approach. *Journal of Electronic Commerce Research, 17*(1), 47–64. http://www.jecr.org/node/486

Zenone, M., & Snyder, J. (2019). Fraud in medical crowdfunding: A typology of publicized cases and policy recommendations. *Policy and Internet, 11*(2), 215–234. https://doi.org/10.1002/poi3.188

Zetzsche, D., & Preiner, C. (2018). Cross-border crowdfunding: Towards a single crowdlending and crowdinvesting markets for Europe. *European Business Organization Law Review, 19*(2), 217–251. https://doi.org/10.1007/s40804-018-0110-x

Mina Fanea-Ivanovici was born in Bucharest, Romania, in 1983. She received the Ph.D. degree in Economics in 2010. She has a Master's Degree in Finance and Management Controlling with the Université d'Orléans. She did her Bachelor's Degree in Business Administration at the Bucharest University of Economic Studies and in Business Administration and Management, Small and Medium-Sized Enterprises at the Université Paris XII Val-de-Marne. She is currently an Associate Professor at the Department of Economics and Economic Policies at the Bucharest University of Economic Studies. Her main research interests revolve around areas such as: creative economy, creative industries, cultural economy, crowdfunding, knowledge management, intercultural dialogue and intercultural competencies. She has published numerous articles and books, and was a member in five research projects, and director of one research project.

Marius-Cristian Pană was born in Roșiori de Vede, Teleorman County, Romania, in 1979. He received the Ph.D. degree in Economics at the Bucharest University of Economic Studies. He graduated Postdoctoral Studies at the Romanian Academy in 2015. He has a Master's Degree and a Bachelor's Degree in Economics and Business Law at the Bucharest University of Economic Studies, Faculty of Economics. He is an Associate Professor at the Department of Economics and Economic Policies at the Bucharest University of Economic Studies. He is the author or coauthor of five books and numerous articles concerning research domains as institutional economics, transaction costs economics, economics of education. He was also a member in many research projects during 2002–2010.

The Role of Smart Cities in Stimulating and Developing Entrepreneurship

Laura-Diana Radu and Ana Iolanda Voda

Abstract The relationship between the smart city and entrepreneurship is bidirectional. A smart city offers new opportunities for entrepreneurship to achieve sustainable development of urban communities. They bring new challenges for entrepreneurs that must activate in ultra-connected and intelligent environments, characterized by continuous innovation. They also have some significant benefits in smart cities. One of them is the availability and quality of information and communication technologies that offer access to data and services and allow us to discover new knowledge and to implement new business ideas. The real-time connection between entrepreneurs and between entrepreneurs and government is another advantage for entrepreneurs that facilitates the exchange of information and access to the recent business ideas and innovation. The availability of highly skilled human resources is another benefit. The entrepreneurs have access to smart, creative, and involved employees that increases the chance of economic success of any viable business. The interest in social and environmental sustainability is considered another advantage that offers opportunities for entrepreneurs to invest in new green industries to reduce pollution and to support sustainable development. This chapter aims at addressing more broadly, continuative and contrasting insights on the entrepreneurial processes and new business opportunities in smart cities. Our focus will be towards the role cities can have on stimulating and developing entrepreneurship, and on the way, smart cities' challenges could be transformed into opportunities for entrepreneurs.

L.-D. Radu
Accounting, Business Information Systems and Statistics Department, Faculty of Economics and Business Administration, Alexandru Ioan Cuza University, Iasi, Romania
e-mail: glaura@uaic.ro

A. I. Voda (✉)
Social Science and Humanities Research Department, Institute of Interdisciplinary Research, Alexandru Ioan Cuza University, Iasi, Romania

A. Visvizi and O. Troisi (eds.), *Managing Smart Cities*,
https://doi.org/10.1007/978-3-030-93585-6_8

1 Introduction

The concept of a smart city although it has been used frequently in the literature, there is a lack of consensus on its meaning. In general, smart cities "make use of information and communication technologies (ICT) to help cities in developing their competitive advantage" (Trindade et al., 2017; Visvizi et al., 2017). The developed functionalities and smart characteristics are a response to the increasing population density from the urban areas, and issues as urban agglomerations, air pollutions, waste management should be addressed. The smart cities activities are developed in a unifying and complementary way, citizen centred.

In the last decades, smart cities debates can be divided into two groups: a consistent body of literature that focuses on ICT uses and applications, while the other provides important details on different issues associated with social sciences and humanities (Lytras & Visvizi, 2018). Despite the increased interest from known policymakers, little information has been provided on how entrepreneurship influence smart cities development and on how smart cities can create new opportunities for entrepreneurs. Entrepreneurship represents a vital ingredient for economic development, employment, and innovation (Andersson & Koster, 2011; Vodă and Florea, 2019). According to the United Nations Sustainable Development Goals (SDGs) by investing in entrepreneurial activities three main goals could be achieved: reducing poverty, promoting inclusive and sustainable growth, and decreasing inequality.

The relationship between entrepreneurship and the smart city has both an owning side and an inverse side. First, entrepreneurs invest in developing and marketing technologies necessary for transforming cities into smart cities. These technologies need to be smart and sustainable to improve citizens' well-being. Second, the adoption of these technologies offer access to data and services and allow to discover new knowledge and to implement new business ideas, which further can be exploited by enterprises (Van den Buuse and Kolk, 2019). Despite the potential of this bidirectional relation, this connection has been less investigated in the literature.

This chapter aims at addressing more broadly, continuative and contrasting insights on the entrepreneurial processes and new business opportunities in smart cities. Our focus will be directed towards the role cities can have on stimulating and developing entrepreneurship, and on the way, smart cities challenges can be transformed in opportunities for entrepreneurs.

This research examines the role cities can have on stimulating and developing entrepreneurship highlighting the managerial implications of the development of smart solutions. Smart cities challenges can be transformed into opportunities for entrepreneurs. They approach in a balanced way both the managerial and the technical aspects. We will answer the following three research questions (RQs):

RQ1 What are the key players in creating an inclusive and entrepreneurial smart city?

RQ2 What are the main features of smart cities that stimulate entrepreneurial initiatives?

RQ3 What are the managerial challenges of entrepreneurs in smart cities?

To address these research objectives, the literature was studied. The main results are presented in the following sections. The chapter is organised as follows. Section 2 highlights the relationship between smart cities and entrepreneurship, and the role cities can have on stimulating and developing entrepreneurship, and on the way, smart cities' challenges, and opportunities. Finally, Sect. 3 concludes and discuss the main recommendations.

2 Smart Cities and Entrepreneurship

2.1 Smart Cities as Centres of Entrepreneurship

Many authors found that in smart cities the level of entrepreneurship tends to be higher than in other cities (Hazehjan et al., 2016; Kraus et al., 2015; Tranos & Gertner, 2012). In this regard, the literature suggests that creative regions tend to attract human capital and this movement leads to a greater business dynamic (Barba-Sánchez et al., 2019; Lytras & Visvizi, 2018; Visvizi et al., 2018). Creating an inclusive and entrepreneurial smart city may be achieved by bringing together four key players: government, citizens, corporate firms, and private–public partnerships.

The government, by establishing effective planning of resource allocation and market policies (Kummitha & Crutzen, 2019). Smart cities must provide a framework of governance guided by efficient strategies and policies that support a pro-business and knowledge-based-environment where people, policymakers and key-players can collaborate.

The citizens—creative, talented, and skilled workers, capable of engaging in venture creation (Kummitha, 2019; Kummitha, & Crutzen, 2019). The cities policies must be designed in such a manner that attract and retain talent in urban areas "to form analytical, synthetic and symbolic knowledge bases" (Florida, 2002). Smart people aim to transform the way citizen interact, in a way that supports the creation of an accessible and inclusive environment. E-skills and the level of qualification or education of citizens are also important aspects that need to be considered. Moreover, recent developments in the European Urban Agenda underlines the importance of those entrepreneurial activities orientated towards societal associated challenges and helping design the appropriate urban policies and programs that enhance wellbeing and improve the overall quality of life (McCann & Ortega-Argilés, 2016).

Corporate firms—that through the developed technologies can change a city into a smart one. This process is part of their corporate entrepreneurship strategy (Buuse and Kolk, 2019). Corporate enterprises often develop new knowledge and advance technologies to achieve better products and services. In implementing their corporate strategies, firms can encourage an entrepreneurial and smart environment that is crucial to their success. Some initiative may include the promotion of a greener and safer urban environment, cleaner air and improved public services, initiatives

grounded by the Internet of Things (IoT) and big data analytics that are at the core of the smart city.

"*Small and medium enterprises (SMEs) and social enterprises that create small-scale developmental interventions by promoting public–private partnerships or play regulatory roles*" (Kummitha, 2019). Cities must develop a positive and supporting environment that allows private players, people, and policymakers to collaborate. Such a conductive environment allows SMEs and social enterprises to innovate, to offer advances smart city solutions and actively involved in smart city building. Also, the development of a pro-business city implies a good infrastructure and adequate urban mobility that allows the connection from different points of the city e.g., new offices buildings, residential areas, good infrastructure and so further (Penco et al., 2020). Both urban mobility and city infrastructure are important assets that facilitate the attraction and retention of smart workers.

Isenberg (2011) identified six domains within the entrepreneurial system: culture, policies and leadership, appropriate sources of finance, human capital, venture friendly markets for products and good institutional framework (Fig. 1). Each context requires its ecosystem, due to the highly complex and specific ways of interactions between units and pieces based on the circumstances of the entrepreneurship activities (Isenberg, 2011).

For the smart city to be as a centre of entrepreneurship, six main features should be taken into consideration (Bakici et al., 2013). We discuss these in detail below (Table 1).

Availability and quality of ICT infrastructure and usage. The quality of the available ICT infrastructure represents one of the most important assets in the smart

Fig. 1 Entrepreneurial system fields. *Source* The authors

Table 1 Main features for supporting entrepreneurship in smart cities

Features for smart city	Main characteristics
Availability and quality of ICT infrastructure and usage	Information sharing and collaboration Major differences across EU cities Lack of ICT infrastructure impedes business creation and development
Business-led urban development	Transformative managerial structure Good and supportive institutions
Social inclusion of urban residents in public services	Culture of learning and citizen engagement in public services provision
The role of high-tech and creative industries	Knowledge spill over and knowledge transfer Creativity and management of innovation
The role of social and relational capital	Social networks Civil engagement Trust and cooperative norms
Social and environmental sustainability	Sustainable ecosystems Reduced pollution Reduced traffic/waste management

Source The authors

city. It provides a solid foundation for information sharing, collaboration and interoperability that allows the urban development and welfare (Nam & Pardo, 2011; Schaffers et al., 2011). Lack of ICT infrastructure may act as an entry barrier that impedes entrepreneurs to engage in venture creation at the local and regional level. Although in many European cities the ICT infrastructures are considered as given for a business location, there are still major differences between urban and rural areas (Kraus et al., 2015).

Business-led urban development. Represents a transformation process from a managerial to an entrepreneurial perspective that fosters urban growth and encourages public–private partnerships and private capital investments (Kraus et al., 2015). In the new urban governance, public institutions may play a dual role: they can act as a catalyst in encouraging smart development by proving strong public funds (Lee et al., 2014) or they may foster and attract private capital to ensure urban development (Hollands, 2008). Either way, a good institutional framework is mandatory in encouraging entrepreneurial activities in any forms.

Social inclusion of urban residents in public services. It incorporates the provision of governmental services to all urban residents, citizens, businesses, and employees using for instance ICT processes (Caragliu et al., 2011; Kraus, 2015). Technology can assume different functions within social and political participation and inclusion processes. For instance, open access to data and shared comprehension of it can redefine political power relations, as well as rights, claim possibilities (Albuquerque, 2017). This helps to create a culture of learning based on community dynamics, allowing urban residents the possibility to be involved and actively participate in the process.

The role of high-tech and creative industries. In the "new urban world", creativity, innovation, entrepreneurship, and spatial competitiveness represent the main ingredients that assure metropolitan areas and cities increased growth. Here, social networks and skilled labour force agglomeration offers spatial advantages related to knowledge spill over effects and fosters knowledge transfer (Kourtit et al., 2012). Proximity and agglomeration represent other important elements in urban economies development and growth. The agglomeration of activities, involving spatial and social proximity, reduces knowledge workers interaction costs and increases workers' productivity (Florida, 2002; Kourtit et al., 2012). The availability of new and specialized knowledge may act as a magnet in attracting more specialized workers and creative people, however, this large number of like-minded urban residents and entrepreneurs may generate a higher level of competition. At the same time, they ensure the delivery of innovation at a faster pace (Kraus, 2015). But for an urban residence to identify and evaluate business opportunities and transform ideas in real venture creations, they need a creative business environment that sustains the development of relevant technical and business aspects.

The role of social and relational capital. Social capital is a broader concept. For instance, Porta et al. (1996) define social capital by underling the norms of reciprocity and trustworthiness that connections among individuals generate. Other authors view social capital as the propensity of individuals to invest in social relations and networks to produce expected returns (Dubos, 2017). A more general overview on the notion is provided by Scrivens and Conal (2013) who define the concept using four pillars: (a) personal relationships; (b) social network support; (c) civil engagement and (d) trust and cooperative norms. In societies with high levels of social capital, incentives for opportunistic behaviour are reduced, and consequently corruption (Putnam, 1995). For entrepreneurs, these social networks have been used consistently by individuals to recognize entrepreneurial opportunities and as a mean through which actors gain access to different tangible and intangible resources, tacit or explicit information and even emotional support (Ma et al., 2011). In the urban world, market, and power relationships, alongside cooperation between individuals, firms and institutions are essential in achieving sustainable growth. For example, in smart cities networks and alliances allowed firms to share development risks and to access synergistic knowledge, which in turn generated an increased innovation capacity at a faster peace and higher performance (Russell et al., 2015). From the perspective of individuals, social networks can provide the support they need in identifying key problems and tangible solutions that can transform themselves into viable businesses. This potential source of generating new business ideas can help attain quality jobs and spur sustainable economic growth. However, a critical aspect for smart city applications utilisation is connected to data sharing. Adopting citizen-centric initiatives, where the issues of privacy and safety are brought to the core, are crucial for the success of a smart city (Lytras et al., 2020).

Social and environmental sustainability. One of the major challenges for urban policymakers is to build cities that function as sustainable ecosystems, focused on reducing pollutions, traffic or waste management or other related sustainable actions. These cities need to develop and implement efficient measures that enhance the

quality of life of its citizens, the provision and management of public services and long-term sustainability. However, given the high density of population agglomeration, in cities, the use of resources and the volume of waste is usually high (Gleeson & Low, 2000). Against such a backdrop, smart cities must deploy high-impact interventions that will improve the likelihood of sustainable change. Entrepreneurs can also gain financial benefits from sustainability investments. Some examples may include better access to certain markets; differentiated products; revenue from selling green technology; lower cost of material, energy, and services; better risk management and relations with external stakeholders; lower cost of capital and labour (Ambec & Lanoie, 2008).

2.2 The Main Determinants of Entrepreneurship and Economic Performance in Cities

In the spatially orientated entrepreneurship research, a generally accepted statement acknowledges that entrepreneurship can be considered a "regional event" (Feldman, 2001). This implies that entrepreneurial activities, besides other factors, are influenced by the local context where the entrepreneur and start-up are located (Vodă and Florea, 2019; Vodă et al., 2020). For example, the formal institutions, entrepreneurial culture, available infrastructure, human capital may affect the relationship between entrepreneurship and economic performance in cities (Audretsch et al., 2015; Szerb et al., 2013). For instance, the study developed by Audretsch et al. (2015) on the link between European new firm start-ups and economic development shows that the market size and market entry are significant factors that shape the overall environment of the city. The increased market size may bring positive changes that augment the number of potential entrepreneurs to start a new business.

Other cross-regional studies focused on the relationship between population size, the density of cities and new firm creation. However, there little understanding of whether density or size are direct factors or mediating/moderating factors in promoting entrepreneurship (Florida et al., 2012). For instance, some studies underline the positive and direct effects on size and density on venture capital-based start-ups. According to Armington and Acs (2002), the agglomeration effects come either from the demand size e.g., an increase in population or firm regional spill overs e.g., labour market characteristics. The large concentration of firms in urban areas represents a pooled market for smart workers, ensuring a higher probability of employment and a lower probability of labour shortages (Krugman, 1991). Thus, a large agglomeration of firms in specialized hubs is not exempt from adverse effects on the economy e.g., increase in houses and land pricing, higher wage rates, among others. Nevertheless, the positive effects must overweight the negative externalities and maximize the positive effects for a city to transform into a specialized hub. The positive effects must be sustained by a capable and effective government structure (Glaeser, 2011).

On the other hand, other studies reveal that entrepreneurial ecosystems although are geographically bounded, they are not particularly related to the city size (Mason & Brown, 2014). Similarly, Florida et al. (2012) underline that although some major European cities have a high-density rate, they are hardly known for their entrepreneurial activities (e.g., Napoli, Italy).

Considered the increased attention on urban areas and entrepreneurship, other research found that cultural richness, economic diversity, international connectivity, and infrastructure excellence proved to be valuable assets that regional entrepreneurship relies on (Acs et al., 2008). Similar results have been found by Bosma and Sternberg (2014) in analysing 23 cities from European Countries. According to their findings, available diversity and expertise in urban platforms are considered as major factors that leads to an increase in entrepreneurship. Sahin et al. (2011) found other determinants as networking, individual and work characteristics as important assets in increasing entrepreneurial rate of cities.

2.3 Entrepreneurship Ideas—Opportunities and Challenges in Smart Cities

Smart cities are a source of opportunities for entrepreneurs, especially in the ICT field. Due to technological progress, they already became interconnected and monitored ecosystems where a wide range of knowledge is generated and disseminated (Barba-Sánchez et al., 2019). These ultra-connected environments generate essential changes in the management activities within the organizations. That might increase entrepreneurial activity (Acs et al., 2005; Scornavacca et al., 2020). The disruptive technologies in smart cities are IoT, communication networks, cloud and edge computing, robotics, drones, self-driving vehicles, blockchain, cognitive computing and big data. Innovations in these fields are expected to improve the quality of life and environmental protection. Waste collection, energy-saving, parking management, calculation of optimal route are some examples. In many cities "entrepreneurship happens by accident and not design" (Stephens, 2019), but smart cities, according to Barba-Sánchez et al. (2019) need explicit strategies to encourage entrepreneurs.

The high complexity of smart cities technical infrastructures and its functionality requires the development of agile management which allow cities to overcome common challenges (financial constraints, implementing digital infrastructures, and poor communication between different stakeholders, public institutions, NGOs and citizens) and enhance their organizational and administrative capacity. In a smart city beside the classical management functions (planning, organization, coordinating and controlling) we also need adding observable indicators for smart city success through the life cycle of an initiative: production of concrete outcomes, scalability capacity and compatibility, secure system infrastructure and automated information systems. Sustainable smart city development and efficient management need implementing a comprehensive and strategic city vision with clear objectives aligned

to policy goals. Moreover, we also need to foster public–private alliances which allow information and knowledge sharing between different public–private entities (cross-organizational management).

City managers should focus on both economic gains and other public values to make city smarter which may include the production of improved outcomes of policies in health, and reducing disparities and, at the same time, develop innovative management mechanism that ensures the success of different smart city projects (Barletta et al., 2020). The literature highlights the role of citizen as individual entrepreneurs in smart cities by creating innovative technologies. In many cases, the goal is solving local problems. This process is helped by access to infrastructure and a large volume of data. In the last years, the number of start-ups, SMEs and social enterprises is continually growing in smart cities context. According to Kummitha and Crutzen (2019), many talented entrepreneurs, trained in an elite institution, migrate in these areas, and create IoT-based interventions.

IBM is a classic example of corporate entrepreneurship in these types of cities. After the 2008 recession, the company encourage its employees to bring new innovative ideas. The smart city was one of this with exciting potential in urban development space. It was a part of the firm's Smarter Planet initiative, a planet more instrumented, interconnected, and intelligent (Paroutis et al., 2014). IBM's vision of the smart city is "the use of information and communication technology to sense, analyse and integrate the key information of core systems in running cities" (Cocchia, 2014). The concept was adopted by developed and developing countries. The global companies were invited to get involved in corporate entrepreneurship. IBM's criteria for smart cities are the presence of data platforms to collect and aggregate a large volume of date from various sources, the redistribution of relevant information at the regional level in an intelligible manner using analytics and cognitive computer and, finally, the active or passive participation of the citizens (Sajhau, 2017). For example, IBM signed a partnership with PSA Group to collect data from car sensors to design the car of the future. Another project that involves citizens uses sensors to collect information about ABS controllers to improve traffic conditions in those areas where they are activated often. Applications for traffic alerts, fault reports, incident reports are based on active citizens implication in smart city creation. Waze is an example of an application based on the active participation of the citizens. These data are useful not only for drivers themselves but may be used by local authorities in mobility platforms. Accidents and traffic jams warning reported by drivers are more credible for users if they are certified by authorities. Boston (USA), Rio de Janeiro (Brazil), Washington (USA), London (UK), Barcelona (Spain) are smart cities where local governments create a partnership with Waze. In exchange, local authorities sent real-time government-reported construction, crash, and road closure data.

Technology corporations, such as IBM, Accenture, Cisco, Siemens, General Electric, Google, Hitachi, HP, Toshiba et al. started to invest in smart cities projects and to benefit from these projects (Bulkeley et al., 2016; Gabrys, 2014). For example, smart grid projects attracted significant public and private investments (EU Strategic Energy Technology Plan, the UK's energy regulator-led Low Carbon Network Fund, IBM, Cisco, Toshiba, Google, General Electric, Hitachi). Using intelligent energy

systems minimize some problems such as energy losses of long-distance transportation (Farmanbar et al., 2019). Smart grids start with real-time monitoring, automation and self-controlling issues and continue with the provision of sustainable energy resources, mostly renewables. IBM and Veolia in Lyon, France, in 2013, implemented a project to manage drinking water production and distribution for 25 years. The information related to water quality, water leaks and pressure are collected using sensors, detectors and valves and are transmitted together with all data available through data open in real-time to inform citizens and to eradicate the dysfunctions.

Array of Things (AoT) is a collaborative project between industry, scientists, universities, government, and communities (AoT, 2020). AoT uses Waggle, a platform based on open intelligent sensing and edge computing, to collect real-time data on the urban environment, infrastructure, and activity. Its application includes sensors monitoring air quality (carbon monoxide and nitrogen dioxide levels), sound, and vibration, real-time detection of urban flooding, measurements of micro-climate in different areas, the most populated areas of the city. The data can suggest healthiest and safeties routes, to improve city services and infrastructure, to reduce congestion-related pollution et al.

Siemens has developed City Air Management (CyAM) project to collect data on air pollution from the sensors installed across Singapore and to forecasts to five days in advance based on deep neural network. This software helps reducing nitrogen oxides and atmospheric particulate matter. Green Horizon Project launched by IBM in 2014, help China to improve air quality. Real-time data about Beijing's air quality are collected and based on them the government will be able to act to solve environmental problems by adjusting production at specific factories or alerting citizens about developing air quality issues (IBM, 2014).

Hackathons, organized by companies sometimes in partnership with local administration, university, and start-ups, have a significant role in fostering innovation, entrepreneurship, and social enterprises. There are hackathons dedicated to smart cities or to other themes needed to implement smart cities, such as IoT, big data, energy, health etc. The participants, coders, markers, experts, UI/UX designers, entrepreneurs etc., work in teams to produce prototype solutions to some challenges set. At the end of the weekend, a winner prototype is announced, and, in some cases, it can have the chance to be launched into production and on the market. Multinational IT corporations (such as IBM, Intel, Amazon, Microsoft, Facebook etc.) and governmental agencies sponsor hackathons that have themes related to smart cities and technologies. They help participants by offering expertise regarding managerial implications of transforming inventions in innovation with market value. According to Perng et al. (2018), "hackathons are seen as a key pathway to foster entrepreneurship and innovation" in the smart cities case. Some winners can get access to business networks or investment by multinational companies or venture capital to transform their product into a marketable one. These projects increase the efficiency of public services through technological innovations and help the transition from managerial to entrepreneurial urban governance (Datta, 2015; Perng et al., 2018). For example, Zaarly (2011) an app designed for hiring and scheduling different kinds of local services, Docray (2011) software that allows the business to

locate legal documents safety, CondoLife (2017) an electronic management system for condominiums, Greenifier (2019) an app that to gamifying the urban mobility concept in a challenging eco-friendly game, Internet of Parks (2015) an automatized cleaning solution for public spaces and green areas in Nice (France) are success stories that started at the hackathon.

According to Carè et al. (2018), civic crowdfunding is another method for the engagement, empowerment, and active participation of citizens in entrepreneurial activities in smart cities. It is an alternative financial instrument that has a high potential for entrepreneurial and community development. It allows citizens to propose and finance sustainable local projects using web-based technology. Word Bank (2013) described this model as "a form of capital formation emerged in an organized way in the wake of the 2008 financial crisis largely because of the difficulties faced by artisans, entrepreneurs and early-stage enterprises in raising funds". In smart cities context, crowdfunding has four dimensions: community, civic challenges, social innovation, and civic crowdfunding (Carè et al., 2018). Individuals supply financial resources for projects. Social challenges are the existing local problems that require solutions. Social innovation is defined as innovative ideas that meet social needs and create new relationships or collaborations. This can be new products, services, or business. Civic crowdfunding refers to the differences among smart cities projects. Nowadays, a substantial number of crowdfunding platforms exist. Some examples are: Ioby (an American online community), aims to make urban neighbourhoods a better place to live and Crowdculture (in Sweden) aims to connect social capital with economic capital by micro-financing cultural projects (Bernardino & Santos, 2017), Crowdfund London and Spacehive (in the UK) aim to select a new idea for community-led projects to make the local area even better et al. Also, social networks (such as Facebook) are used in civic crowdfunding campaigns. Crowdfunding platforms provide consulting services to entrepreneurs both on campaign strategy and on the managerial aspects of fundraising.

Open data is also essential for entrepreneurship in smart cities to foster economic progress and innovation. These are data "freely accessible online, available to be reused without barriers due to technical constraints, provided under open access allowance that permits them to be reused without constructions" (Kitsios et al., 2017a, b). These initiatives have four main categories of influences in smart cities (Verhulst & Young, 2017): create economic opportunity, including enable business creation, new forms of innovation and stimulate economic growth, offer solutions for complex public problems, improve governance, and empower citizens. Regarding managerial implications, open data improves long-term management strategy, allows greater transparency in finance management, cost reductions and timesaving. For entrepreneurs, they are a new business asset, available free of charge that can be used together with proprietary data to improve the results of predictive analyses and, implicitly, managerial decisions. Access to date will stimulate the creation of new products and services that can deliver social and economic value. Entrepreneurs have a significant role during the entire life cycle of the open data initiative. Stakeholders involved are various (private companies, academic institutions, and citizens). Their

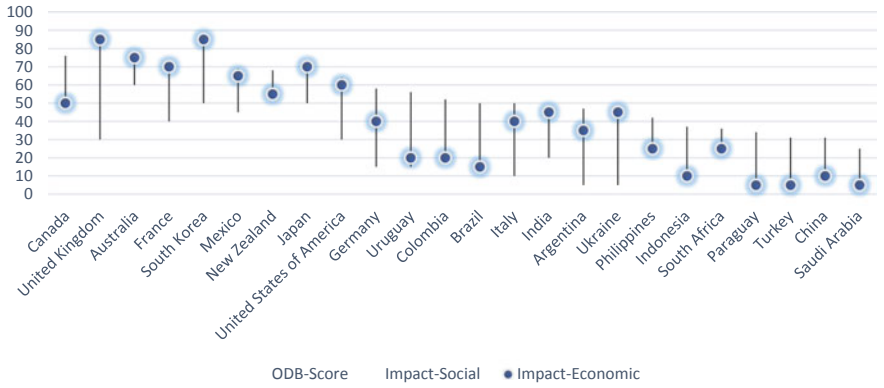

Fig. 2 Economic and social impact of open data. *Source* The authors

involvement during the early stage of the project increases the sense of community (Berrone et al., 2016). In Barcelona, in 2014, Microsoft and Schneider Electric launched the Efficient Energy Appathon to increase the level of information about energy sustainability and to create more awareness about the need for energy conservation. According to Anthopoulos (2017), smart cities are supported by "partnerships between cities and corresponding vendors". This is the case of open data since it needs a huge volume of technologies, both hardware and software, to collect, store, process and analyse a huge volume of data. Most local governments do not have these resources. This is one of the reasons that entrepreneurs have a particularly significant role and partnerships between public authorities and the private sector are essential. They supply hardware and software for producing, capturing, analysing, and broadcasting city data and to transform data in information and information in value for all involved stakeholders. Open Data Barometer (ODB) analyses the impact of open data initiatives on business, politics, and civil society. Figure 2 presents this influence, based on data offered by Web Foundations (2018a), only on business and society since both social and business networks play an equally key role in the entrepreneurial process (Kirsios and Kamariotou, 2017). In some countries open data score has a greater social impact, in other countries has a greater business impact. We cut those countries with zero economic or social impact.

Open Data Barometer (ODB) is an example of a successful open data project for smart cities. ODB aims to uncover the true prevalence and impact of government open data initiatives worldwide based on three main pillars: readiness; implementation of open data programs and impact assessment on open data on business, politics, and civil society. According to their results, open data has a positive impact on economic life in smart cities. It contributes to economic growth in the USA and delivers business opportunities and increases sectors efficiency. In some countries, such as Australia, Mexico, USA, Italy, South Korea, Canada et al. "hundreds of data-based companies have flourished (…) creating new market opportunities and data business models"

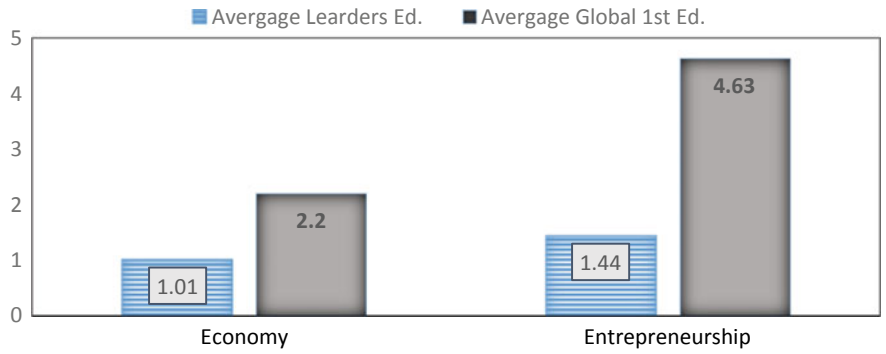

Fig. 3 Open data impact on economy and entrepreneurship. *Source* The authors

(Web Foundation, 2018b). Comparing to the first edition average impact of open data has increased both for economy and entrepreneurship (Fig. 3).

The first study was made on 77 governments in 2013 and the last one, in 2017, on the leaders, respectively on 30 governments that have committed by adopting the Open Data Charter, or by signing up to the G20 Anti-Corruption Open Data Principles. For instance, the development of G20 Open data Principles by the Anti-corruption working group enables an increase in the quality of available data, reinforce transparency, increase trust, and can help prevent, detect, investigate and fight against corruption and illegal acts.

Elapedia App (2017) is a successful open data project with direct private implication. It is a joint venture between the Center for International Private Enterprise (CIPE) and the Governance Consultants that gives investors access to corporate governance practices at 100 publicly traded companies in the four Pacific Alliance countries (Chile, Colombia, Mexico and Peru).

In Europe, Urban Data Platform Plus facilitates data sharing and comparative research across the European Union (EU). The platform provides access to information on the status and trends, grouped on thematic, of cities and regions from EU.

Lakomaa and Kallberg (2013) consider open data impact on entrepreneurial innovation so high that "political executives could be left with two choices – feasible climate for Internet start-up's innovation or bureaucratic data retailing – and they cannot have both".

In some cases, hackathons' participants also benefit from open data. They use open data and organizers' resources to develop the project. This practice reduces costs and increases the quality of managerial decisions adopted. The participants can extend the apps and create a new start-up transforming the latest ideas in innovation with market value. A survey that links open data and entrepreneurship reveals that 83% of entrepreneurs considered the access to open data essential to create their business plan and 43% of respondents claimed that access to public sector information open data was required to apply their business plans (Lakomaa & Kallberg, 2013).

To support entrepreneurship in a smart city context, the use of living lab to foster entrepreneurial acquisition involving experienced entrepreneurs was suggested by some authors (Sauer, 2012; Scornavacca et al., 2020).

3 Conclusions and Recommendations

Entrepreneurship influences smart cities development and smart cities create new opportunities for entrepreneurs. Their investment in technologies contributes to the creation of the hyper-connected cities. At the same time, the data received help them to explore new business opportunities. This paper presents the most significant features, ideas, opportunities, and challenges for entrepreneurs in the smart city. The results can help city managers turn the challenges and criticalities of smart cities into opportunities.

Smart cities offer numerous opportunities for entrepreneurs. To succeed they must find innovative ideas and mechanisms to implement them. Local administrations have a significant role. Promoting public–private partnerships and taking part in the regulatory process are the two approaches that give entrepreneurs the confidence to get involved. There is high competitiveness between smart cities in attracting global capital, the best ideas, and the most intelligent people. In this specific context, local administrations must sell the image, promises and new standards of life. The most attractive and accessible innovations are related to ICT supported by urban politics that prioritizes investments in technology dedicated to affordable housing, transport, health, sewerage, and transport. Smart cities have important managerial implications. Ultra-connected devices offer access to a large volume of information available as open data or proprietary data that help entrepreneurs to adopt decisions based on better predictive analyses. They must transform the challenges of this multitude of data and technologies in opportunities for the development of new, innovative products and services. This is possible by becoming part of these innovative industries. Participating in hackathons, organizing crowdfunding campaigns, project ideas to support the development of smart cities are opportunities that can be exploited by entrepreneurs. To be successful, they must continuously adapt their managerial strategies and policies to the environmental changes.

This paper has several managerial implications. First, it suggests that smart cities offer a favourable environment for innovative business. Entrepreneurs have access to a various source of funding, such as crowdfunding, angel investors, venture capital, complex data and performant analysis tools for decision-making, the latest ideas proposed by the best specialists. Second, it posits that despite this opportunities, smart cities can lead to challenges for entrepreneurs such as the need to assimilate the latest technologies and trends, highly competitive context, extremely dynamic market, the avalanche of information and, sometimes, the difficulties it generates in making decisions. Initiatives related to sustainability and health have the potential to be transformed into a successful business. However, investment performance needs to be carefully pre-calculated.

These days, the life of all citizen is significant influenced by the COVID-19 pandemic. In this context, contact tracing apps used to identify direct contacts of confirmed positive cases has a positive impact in limiting the spread of the virus. Due to the breadth of technologies existing in smart cities, these initiatives have been easy to implement. AI, machine learning, sensors, etc. already used in various applications were valuable tools in this case. Due to these technologies, a significant number of citizens can continue their life with minimum negative impact, the city management was more effective, and administrative decisions were easier to adopt and implement. The need for new technologies or redesign the present ones create new business opportunities for entrepreneurs; many of them related to data collection and processing. However, citizens' implication is still essential. Without their involvement, even the grandest ideas will not succeed. They are the big winners of the new, hyper-connected smart city and must constantly contribute to the growth of its intelligence by accepting, selecting, using updating, and increasing technology and, in the actual context, by limiting the spread of the virus.

Acknowledgements This work was supported by Jean Monnet Module "European Smart Cities for Sustainable Development"—SmartEU, co-funded by the European Union (620415-EPP-1-2020-1-RO-EPPJMO-MODULE)

References

Acs, Z., Bosma, N., & Sternberg, R. (2008). The entrepreneurial advantage of world cities—Evidence from global entrepreneurship monitor data. *Jena Economic Research Papers, 63*, 1–28.

Acs, Z. J., Braunerhjelm, P., Audretsch, D. B., & Carlsson, B. (2005). The knowledge spillover theory of entrepreneurship. *Small Business Economics, 32*(1), 15–30.

Albuquerque, C. M. P. (2017). Cities really smart and inclusive. In L. C. Carvalho (Ed.), *Handbook of research on entrepreneurial development and innovation within smart cities*. IGI Global.

Ambec, S., & Lanoie, P. (2008). Does it pay to be green? A systematic overview. *Academy of Management Perspectives, 22*(4), 45–62.

Andersson, M., & Koster, S. (2011). Sources of persistence in regional start-up rates—Evidence from Sweden. *Journal of Economic Geography, 11*(1), 179–201.

Anthopoulos, L. G. (2017). *Understanding smart cities: A tool for smart government or an industrial trick?* Springer International Publishing.

AoT. (2020). *What can be done with AoT data?* Retrieved May 13, 2020, from https://arrayofthings.github.io/#

Armington, C., & Acs, Z. (2002). The determinants of regional variation in new firm formation. *Regional Studies, 36*, 33–45.

Audretsch, D. B., Belitski, M., & Desai, S. (2015). Entrepreneurship and economic development in cities. *Annals of Regional Science, 55*(1), 33–60.

Barba-Sánchez, V., Arias-Antúnez, E., & Orozco-Barbosa, L. (2019). Smart cities as a source for entrepreneurial opportunities: Evidence for Spain. *Technological Forecasting and Social Change, 148*, 119713.

Bakıcı, T., Almirall, E., & Wareham, J. (2013). A smart city initiative: the case of Barcelona. *Journal of the knowledge economy, 4*(2), 135−148.

Barletta, V. S., Caivano, D., Dimauro, G., Nannavecchia, A., & Scalera, M. (2020). Managing a smart city integrated model through smart program management. *Applied Sciences, 10*(2), 714.
Bernardino, S., & Santos, J. F. (2017). Potential of civic crowdfunding to the intelligence of cities and social innovation: An exploratory study. In P. Silva, R. Quaresma, & T. Oliveira (Eds.), *Atas da Conferência da Associação Portuguesa de Sistemas de Informação* (pp. 311–323). Associação Portuguesa de Sistemas de Informação.
Berrone, P., Ricart, J. E., & Carrasco, C. (2016). The open kimono: Toward a general framework for open data initiatives in cities. *California Management Review, 59*(1), 39–70.
Bosma, N., & Sternberg, R. (2014). Entrepreneurship as an urban event? Empirical evidence from European cities. *Regional Studies, 48*, 1016–1033.
Bulkeley, H., McGuirk, P. M., & Dowling, R. (2016). Making a smart city for the smart grid? The urban material politics of actualising smart electricity networks. *Environment and Planning A: Economy and Space, 48*, 1709–1726.
Buuse, D., & Kolk, A. (2019). An exploration smart city approaches by international ICT firms. *Technological Forecasting and Social Change, 142*, 220–234.
Caragliu, A., Del Bo, C., & Nijkamp, P. (2011). Smart cities in Europe. *Journal of Urban Technology, 18*(2), 65–82.
Carè, S., Trotta, A., Carè, R., & Rizzello, A. (2018). Crowdfunding for the development of smart cities. *Business Horizons, 61*(4), 501–509.
Cocchia, A. (2014). Smart and digital city: A systematic literature review. In R. P. Dameri & C. Rosenthal-Sabroux (Eds.), *Smart city* (pp. 13–43). Springer International Publishing.
Datta, A. (2015). New urban utopias of postcolonial India: 'Entrepreneurial urbanization' in Dholera smart city, Gujarat. *Dialogues in Human Geography, 5*(1), 3–22.
Dubos, R. (2017). *Social capital: Theory and research.* Routledge.
Elapedia App. (2017). *Mobile app gives investors instant access to corporate governance information.* Retrieved May 23, 2020, from https://www.cipe.org
Farmanbar, M., Parham, K., Arild, Ø., & Rong, C. (2019). A widespread review of smart grids towards smart cities. *Energies, 12*(23), 4484.
Feldman, M. P. (2001). The entrepreneurial event revisited: Firm formation in a regional context. *Industrial and Corporate Change, 10*(4), 861–891.
Florida, R. (2002). The economic geography of talent. *Annals of the Association of American Geographers, 92*(4), 743–755.
Florida, R., Mellander, C., Stolarick, K., & Ross, A. (2012). Cities, skills and wages. *Journal of Economic Geography, 12*(2), 355–377.
Gabrys, J. (2014). Programming environments: Environmentality and citizen sensing in the smart city. *Environment and Planning D: Society and Space, 32*(1), 30–48.
Glaeser, E. (2011). Cities, productivity, and quality of life. *Science, 333*, 592–594.
Gleeson, B., & Low, N. (2000). *Cities as consumers of the world's environment. Consuming cities: The urban environment in the global economy after the Rio Declaration* (pp. 1–29). Routledge.
Hazehjan, M. B., Pirannejad, A., Zarandi, H. M., & Amiri, M. (2016). Identifying effective economic factors on urban entrepreneurship (Case Study: City of Tehran). *A Quarterly Journal of Urban Economics and Management, 5*, 81–96.
Hollands, R. G. (2008). Will the real smart city please stand up? Intelligent, progressive or entrepreneurial? *City, 12*(3), 303–320.
IBM. (2014). *IBM research launches project "green horizon" to help China deliver on ambitious energy and environmental goals.* Retrieved June 18, 2020, from https://www-03.ibm.com/press/us/en/pressrelease/44202.wss
Isenberg, D. (2011). How to foment an entrepreneurial revolution. *The Babson Entrepreneurship Ecosystem Project, 781*, 1–7.
Kitsios, F., Kamariotou, M., Sindakis, S., & Theodorou, P. (2017a). From apps to startups: Success factors for new entries in open data ecosystem. In S. Sindakis & P. Theodorou (Eds.), *Global opportunities for entrepreneurial growth: Coopetition and knowledge dynamics within and across firms* (pp. 337–354). Emerald Group Publishing.

Kitsios, F., Papachristos, N., & Kamariotou, M. (2017b). Business models for open data ecosystem: Challenges and motivations for entrepreneurship and innovation. In *Proceedings of 19th IEEE international conference on business informatics (CBI'17)* (pp. 398–408). IEEE.

Kourtit, K., Nijkamp, P.. & Arribas, D. (2012). Smart cities in perspective–a comparative European study by means of self-organizing maps. *Innovation: The European Journal of Social Science Research, 25*, 229–246.

Kraus, S., Richter, C., Papagiannidis, S., & Durst, S. (2015). Innovating and exploiting entrepreneurial opportunities in smart cities: Evidence from Germany. *Creativity and Innovation Management, 24*(4), 601–616.

Krugman, P. (1991). Increasing returns and economic geography. *Journal of Political Economy, 99*(3), 483–499.

Kummitha, R. K. R. (2019). Smart cities and entrepreneurship: An agenda for future research. *Technological Forecasting and Social Change, 149*, 119763.

Kummitha, R. K. R., & Crutzen, N. (2019). Smart cities and the citizen-driven internet of things: A qualitative inquiry into an emerging smart city. *Technological Forecasting and Social Change, 140*, 44–53.

Lakomaa, E., & Kallberg, J. (2013). Open data as a foundation for innovation: The enabling effect of free public sector information for entrepreneurs. *IEEE Access, 1*, 558–563.

Lee, J. H., Hancock, M. G., & Hu, M. C. (2014). Towards an effective framework for building smart cities: Lessons from Seoul and San Francisco. *Technological Forecasting and Social Change, 89*, 80–99.

Lytras, M. D., & Visvizi, A. (2018). Who uses smart city services and what to make of it: Toward interdisciplinary smart cities research. *Sustainability, 10*(6), 1998.

Lytras, M. D., Visvizi, A., Chopdar, P. K., Sarirete, A., & Alhalabi, W. (2020) Information management in smart cities: Turning end users' views into multi-item scale development, validation, and policy-making recommendations. *International Journal of Information Management*, 102146.

Ma, R., Huang, Y. C., & Shenkar, O. (2011). Social networks and opportunity recognition: A cultural comparison between Taiwan and the United States. *Strategic Management Journal, 32*(11), 1183–1205.

Mason, C., & Brown, R. (2014). *Entrepreneurial ecosystems and growth-oriented entrepreneurship.* Final Report to OECD.

McCann, P., & Ortega-Argilés, R. (2016). Smart specialisation, entrepreneurship, and SMEs: Issues and challenges for a results-oriented EU regional policy. *Small Business Economics, 46*(4), 537–552.

Nam, T., & Pardo, T. A. (2011) Conceptualizing smart city with dimensions of technology, people, and institutions. In *Proceedings of the 12th Annual International Digital Government Research Conference: Digital Government Innovation in Challenging Times* (pp. 282–291).

Paroutis, S., Bennett, M., & Heracleous, L. (2014). A strategic view on smart city technology: The case of IBM Smarter Cities during a recession. *Technological Forecasting and Social Change, 89*, 262–272.

Penco, L., Ivaldi, E., Bruzzi, C., & Musso, E. (2020) Knowledge-based urban environments and entrepreneurship: Inside EU cities. *Cities, 96*, 102443.

Perng, S. Y., Kitchin, R., & Mac Donncha, D. (2018). Hackathons, entrepreneurial life and the making of smart cities. *Geoforum, 97*, 189–197.

Porta, R. L., Lopez-De-Silane, F., Shleifer, A., & Vishny, R. W. (1996). Trust in large organizations. *National Bureau of Economic Research*, No. w5864.

Putnam, R. D. (1995). Tuning in, tuning out: The strange disappearance of social capital in America. *PS: Political Science and Politics, 28*(4), 664–683.

Russell, M. G., Huhtamäki, J., Still, K., Rubens, N., & Basole, R. C. (2015). Relational capital for shared vision in innovation ecosystems. *Triple Helix, 2*, 1–36.

Sahin, M., Nijkamp, P., & Stough, R. (2011). Impact of urban conditions on firm performance of migrant entrepreneurs: A comparative Dutch–US study. *The Annals of Regional Science, 46*(3), 661–689.

Sajhau, P. (2017). IBM–Building sustainable cities through partnerships and integrated approaches. Field actions science reports. *The Journal of Field Actions, 16*, 52–57 (Special Issue).
Sauer, S. (2012). Do smart cities produce smart entrepreneurs? *Journal of Theoretical and Applied Electronic Commerce Research, 7*(3), 63–73.
Schaffers, H., Komninos, N., Pallot, M., Trousse, B., Nilsson, M., & Oliveira, A. (2011). Smart cities and the future internet: Towards cooperation frameworks for open innovation. In J. Domingue, A. Galis, A. Gavras, T. Zahariadis, D. Lambert, F. Cleary, P. Daras, S. Krco, H. Müller, M.S. Li, H. Schaffers, V. Lotz, F. Alvarez, B. Stiller, S. Karnouskos, S. Avessta, & M. Nilsson (Eds.), *The future internet assembly* (pp. 431–446). Springer International Publishing.
Scornavacca, E., Paolone, F., Za, S., & Martiniello, L. (2020). Investigating the entrepreneurial perspective in smart city studies. *International Entrepreneurship and Management Journal*, 1–27.
Scrivens, K., & Smith, C. (2013). *Four interpretations of social capital: An agenda for measurement*. OECD Statistics Working paper, OECD.
Stephens, M. (2019). Cities as custodians for entrepreneurial opportunity. In M. N. Iftikha, J. Justice, & D. B. Audretsch (Eds.), *Urban studies and entrepreneurship* (pp. 19–30). Springer International Publishing.
Szerb, L., Acs, Z., Autio, E., Ortega-Argiles, R., & Komlosi, E. (2013). *REDI: The Regional Entrepreneurship and Development Index—Measuring regional entrepreneurship.* Final report. Retrieved May 15, 2020, from http://ec.europa.eu/regional_policy/index_en.cfm
The World Bank. (2013). Crowdfunding's Potential for the Developing World. 2013. infoDev, Finance and Private Sector Development, World Bank.
Tranos, E., & Gertner, D. (2012). Smart networked cities? *Innovation: The European Journal of Social Science Research*, 25: 175–190.
Trindade, E. P., Hinnig, M. P. F., Moreira da Costa, E., Marques, J. S., Bastos, R. C., & Yigitcanlar, T. (2017). Sustainable development of smart cities: A systematic review of the literature. *Journal of Open Innovation: Technology, Market, and Complexity, 3*(3), 11.
Van den Buuse, D., & Kolk, A. (2019). An exploration of smart city approaches by international ICT firms. *Technological Forecasting and Social Change, 142*, 220–234.
Verhulst, S. G., & Young, A. (2017). *Open data in developing economies: Toward building an evidence base on what works and how*. African Minds.
Visvizi, A., Mazzucelli, C., & Lytras, M. (2017). Irregular migratory flows. *Journal of Science and Technology Policy Management, 8*(2), 227–242.
Visvizi, A., Lytras, M. D., Damiani, E., & Mathkour, H. (2018). Policy making for smart cities: Innovation and social inclusive economic growth for sustainability. *Journal of Science and Technology Policy Management, 9*(2), 126–133.
Vodă, A. I., & Florea, N. (2019). Impact of personality traits and entrepreneurship education on entrepreneurial intentions of business and engineering students. *Sustainability, 11*(4), 1192.
Vodă, A. I., Butnaru, G. I., & Butnaru, R. C. (2020). Enablers of entrepreneurial activity across the European Union—An analysis using GEM individual data. *Sustainability, 12*(3), 1022.
Web Foundation. (2018a). *Open data barometer—Leaders edition.* World Wide Web Foundation. Retrieved May 15, 2020, from http://www.opendatabarometer.org
Web Foundation. (2018b). *Open data barometer—Leaders edition. From promise to progress.* World Wide Web Foundation. Retrieved July 3, 2020, from http://www.opendatabarometer.org

Laura-Diana Radu, Ph.D. (dr hab.), Associate Professor, Department of Accounting, Business Information Systems and Statistics, Faculty of Economics and Business Administration, Alexandru Ioan Cuza University of Iasi. Her research interests include smart cities development, agile project management, and green and sustainable information systems.

Ana Iolanda Voda, Ph.D., Senior Researcher, Social Sciences and Humanities Research Department, Institute of Interdisciplinary Research; Associated Lecturer at the Faculty of Economics and

Business Administration, Alexandru Ioan Cuza University of Iași, România. Her research interests include entrepreneurship, social inclusion and smart cities.

Smart-Social Business Cities: The Evolution, Concepts, and Determinants

Xhimi Hysa, Alba Kruja, Timothy Hagen, and Esmir Demaj

Abstract Recent research shows the significant role that entrepreneurship has in advancing smart cities. Nonetheless, a big concern is making cities smart and sustainable. The technological aspects must be intertwined with human aspects. Since 2006, when Prof. Muhammad Yunus received the Nobel Peace Prize, the popularity of Social Business has exponentially increased in the marketplace and academia. In the practical context, nowadays many smart cities are at the same time social business cities. An example is the city of Barcelona. Still, the academic research lacks attention in combining the factors who characterizes a city to be both smart and social business oriented. Using a systematic literature review, the current research aims to explore worldwide cities that are simultaneously smart and social business cities, identifying common determinants and synthesizing a conceptual framework for Smart-Social Business Cities. This study concludes with implications and recommendations for governing bodies, academics, and other relevant stakeholders which are part of a city ecosystem.

Keywords Smart city · Social business cities · Smart-social business city · Determinants · Wiesbaden · Barcelona

X. Hysa (✉) · A. Kruja · T. Hagen · E. Demaj
EPOKA University, Rr. Tirane-Rinas Km 12, 1032 Tirana, Albania
e-mail: xhhysa@epoka.edu.al

A. Kruja
e-mail: akruja@epoka.edu.al

T. Hagen
e-mail: thagen@epoka.edu.al

E. Demaj
e-mail: edemaj@epoka.edu.al

A. Visvizi and O. Troisi (eds.), *Managing Smart Cities*,
https://doi.org/10.1007/978-3-030-93585-6_9

1 Introduction

Urban populations have been increasing exponentially during the twenty-first century, with now more than half of the world's population living in cities. The world's urban population increased from 2.3 billion in 1994 to 3.9 billion in 2014 and is projected to grow to 6.3 billion by 2050, (UN, 2014:26). The idea of the 'world city' (Friedmann, 1986) and 'global city' (Sassen, 1991) has been subject of research since the 1980s for better understanding the relationship between urbanization and globalization. In recent years, scientific attention has been oriented more towards issues related to 'smart city' rather than the world city or global city concepts, this associated mostly with technology-based innovation. It is believed that the 'smart city' concept would be the right tool to alleviate challenges brought about by the rapid urbanization processes taking place globally.

Along with city smartness, new forms of business enterprises have emerged as a response to make cities more livable and lives more affordable. A recent report of Deloitte (2018) shows the need for transforming traditional businesses into more social entities that respect economy, society, and the environment, namely Social Enterprises (SE). Companies such as Patagonia and Tom's Shoes are successful examples of SE. One particular type of SE is the Social Business (SB).

Social businesses are driven by social causes (e.g. improving health, overcoming poverty, reducing carbon emissions, increasing cultural awareness, etc.) (Yunus, 2017). Such causes represent the most pressing human needs as envisaged by the United Nations' Sustainable Development Goals. Additionally, an SB is a non-dividend-based company, because all the profits are reinvested into the same business or in another one that promotes a social cause (Yunus & Weber, 2010). The SB movement has been defined as an alternative to the classical capitalism, making it more sustainable (Hysa et al., 2018). Successful examples of social business initiatives are Grameen-Danone, Espigoladors, Magdas Hotel, Youth Albanian Professional Services, etc.

However, SB's are not the only solution proposed for addressing modern social and economic challenges. The smart city is widely viewed as a modern concept referring to a civil or urban area where technological advances are integrated and synchronized to provide quick access to various services and thus improve economic and social conditions of its inhabitants.

A smart city can be more sustainable if it includes more social businesses. Thus, we believe the call for Smart-Social Business Cities is a natural evolution of both cities and businesses, with the latter representing the main development engine of cities. By including businesses in the sustainability agenda of UN's SDGs, we contribute to the sustainability of cities by making them livable and affordable for current and future generations, and by drawing on the smart city model, we seek to optimize efficiencies in promoting economic and social well-being (Lytras et al., 2019). Thus, social business encourages inclusion, a key issue we want to ensure in the smart city.

Past and current literature do not provide a systematic analysis as well as a classification of determinants to involve both social business cities and smart cities. Consequently, a conceptual model that includes both types of determinants it is missing in the literature's state-of-the-art. The current research aims to explore worldwide cities that are simultaneously smart and social business cities, identifying common determinants of each and synthesizing a conceptual framework for Smart-Social Business Cities. As a result, we analyze three research gaps:

Gap 1: the current literature, besides providing relevant information on the factors that characterize a smart city, fails to list smart city determinants.

Gap 2: the current literature, besides providing relevant information on the factors that characterize a social business city, fails to list social business city determinants.

Gap 3: present studies lack the attention on providing a framework that represents cities with features involving both smartness and social entrepreneurship.

This study uses a qualitative method and inductive approach based on city cases literature. Data are gathered through a content analysis of the main studies in the areas of smart cities and social business cities. After considering the most relevant studies and their content, data are clustered as per following research questions, in response to the research gaps:

- What are the determinants of Social Business Cities?
- What are the determinants of Smart Cities?
- How to build Smart-Social Business Cities?

To answer the research questions, this chapter opens with brief perspectives on smart cities (SC) and their potential determinants. It defines the concept of SBC and common determinants of SBCS. After classifying the determinants of SBCs and SCs, an attempt is made to build a conceptual framework for Smart-Social Business Cities characterized by common factors extracted from the previous analyses on SBCs and SCs. This study concludes with implications and recommendations for governing bodies, academics, and other relevant stakeholders which are part of a city ecosystem.

2 Smart City Definition, Concepts, and Determinants

Scientific research regarding the smart city concept is still emerging, making the relevant literature still 'unsaturated' and thus providing for research frontiers in this area. While no universally accepted and clear definition yet exists for the smart city concept, there is consensus among scholars on the positive impact it has in improving the quality of life for members of a specific community scoring high in 'smart city' criteria.

Researchers from different contexts, including academia, corporations, governmental bodies, and NGOs, have elaborated on the smart city concept. In this context, researchers like Giffinger et al. (2007:11) define the smart city as "a city well performing in a forward-looking way in economy, people, governance, mobility,

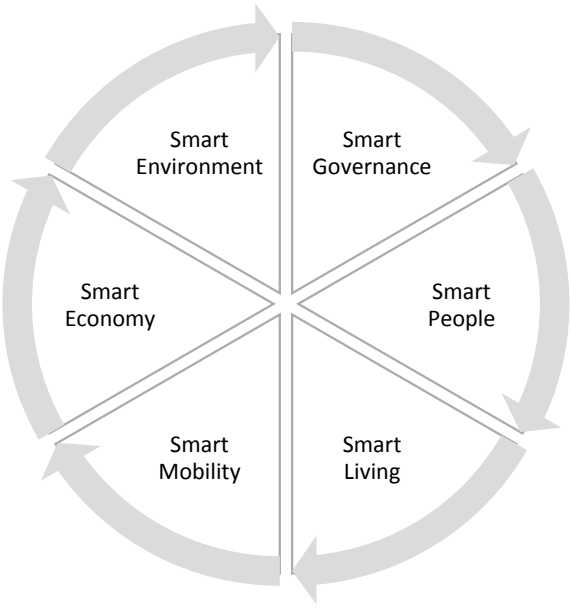

Fig. 1 European smart city model (European Parliament, 2014)

environment, and living, built on the smart combination of endowments and activities of self-decisive, independent and aware citizens". In similar veins, European Smart City Model shown in Fig. 1 below has been developed, this model is built on the 'smart' combination of six key fields of urban development: smart economy, smart people, smart governance, smart mobility, smart environment and smart living. Furthermore, a smart city has a multi-stakeholder approach and as stated in (European Parliament, 2014:18), "the idea of smart cities is rooted in the creation and connection of human capital, social capital and ICT infrastructure in order to generate greater and more sustainable economic development and a better quality of life". So, one could consider the smart city as a concept focusing on a balanced urban ecosystem through a co-creation approach among people, technology, and institutions.

Hollands (2008), another scholar who studied the concept of smart city, considers it as the operationalization of ICT to support social and urban development by enhancing citizens' involvement, governmental efficiency and improving the economy. Lombardi et al. (2011) confirmed through a Triple-Helix network model that a city becoming a smart city is conditioned by universities and industry supporting governmental investments in the development of efficient public management infrastructures and solutions to tackle urban challenges. Deakin (2014) upgraded the Triple Helix model for smart cities with the focus on representing it "as social phenomena that serve to underpin the networking of the intelligence smart cities embed, cultural attributes and environmental capacities which these in turn support" (p. 14).

In similar veins, the smart city concept has received close attention from the industry, where smart city has been studied from an optimization of resources point

of view. IBM (2009) considered a smart city as "one that uses technology to transform its core systems and optimize the return from largely infinite resources" (p. 9). Yoshikawa et al. (2012) in their report, *Hitachi's Vision of the Smart City*, defined the smart city as an environmentally conscious city that uses information technology (IT) to utilize energy and other resources efficiently, thereby maintaining a well-balanced relationship between people and the planet. Furthermore, Cisco (2012) believed smart cities are those which adopt "scalable solutions that take advantage of ICT to increase efficiencies, reduce costs, and enhance the quality of life" (p. 2). However, Visvizi and Lytras (2018) call on considering "sustainability and innovation" as two fundamental features of the same "social challenge".

From a public institutional perspective, the European Parliament (2014), defined a smart city as a city seeking to address public issues via ICT-based solutions based on a multi-stakeholder, municipally based partnership in its M*apping Smart Cities in the European Union* report.

Few scholars have attempted to develop multidimensional frameworks defining a smart city (e.g., Caragliu et al., 2011; Fernandez-Anez et al., 2017), however the European Smart City Model, shown in Fig. 1 above, seems to address a more balanced and sustainable approach. This study too uses the dimensions coined in the European Smart City Model as the basic variables or determinants that define a smart city. This model brings together a large number of indicators clustered into several domains and finally into 6 key fields or determinants which point out to the fact that a successful Smart City should perform well in all these key fields of urban development (Vienna University of Technology, 2015).

In this framework, the human capital side is the starting point of a smart city, instead of considering that ICT can automatically create a smart city (Holland, 2008; Albino et al., 2015). A smart city is the focus of higher education, better-educated individuals, and skilled workforces and Smart People are the protagonists, shaping it through continuous interactions and benefiting from its social capital (Albino et al., 2015; Winters, 2011).

ICT-mediated governance, also called as e-governance, is fundamental in bringing smart city initiatives to citizens, and to keeping the decision and implementation process transparent (Albino et al., 2015, p.12). The Smart Governance dimension is related with the engagement of various stakeholders in decision-making and public services, by integrating when needed public, private, and civil organisations to achieve a citizen-centric, citizen-driven, effective and efficient functioning of the city (European Ciasullo et al., 2020; Parliament, 2014). Deakin (2014) argues that the triple helix model of government-industry-academia collaboration provides a solution to overcome the governance and development challenges of this dimension.

Smart cities are characterised by high productivity due to relatively high share of highly educated people, knowledge-intensive jobs, output-oriented planning systems, creative activities, and sustainability-oriented initiatives (Kourtit et al., 2012). This Smart Economy dimension is associated with the presence of "e-business and e-commerce, increased productivity, ICT-enabled and advanced manufacturing and delivery of services, ICT-enabled innovation, as well as new products, new services and business models" (European Parliament, 2014, p. 28).

Similarly, the Smart Living concept is associated with ICT-enabled lifestyles, behaviour and consumption, related to high levels of social cohesion and social capital, where people live healthy and safe in a culturally vibrant city with diverse cultural facilities and good housing conditions (European Parliament, 2014).

The Smart Mobility dimension is related to a transportation and logistics system supported and integrated by ICT which is sustainable, safe and interconnected among each other, prioritising clean and often non-motorised options, providing real-time information access to the public to save time, save costs, reduce CO2 emissions and improve citizen services (European parliament, 2014).

Environmental concerns were the starting motivation for the smart city advancements. "Smart energy including renewables, ICT enabled energy grids, metering, pollution control and monitoring, renovation of buildings and amenities, green buildings, green urban planning, as well as resource use efficiency, re-use and resource substitution which serves the above goals" are associated to the Smart Environment dimension (European Parliament, 2014, p. 28). The implementation of this dimension stimulates sustainable city growth and a high quality of life through safe, secure environmentally green, and efficient urban centres of the future with advanced infrastructures such as sensors, electronics, and networks (Schaffers et al., 2012).

A summary of the factors characterising each of the six smart city determinants is reported in the Table 1.

Moreover, Visvizi and Lytras (2018, p. 126) urge that a "more structured and output-oriented dialogue among a variety of stakeholders is needed, and that the debate needs to focus on new sustainable, global and socially aware polices for research on smart cities, smart regions and smart clusters". The Smart City research besides the incorporation of technology empowered services on delivering social services, needs also to recognise its users' expectations and preferences especially on issues such as well-being and happiness (Visvizi & Lytras, 2020). Deakin (2018) suggests the integration of the Advanced Triple Helix model of collaboration (Fig. 2) by which the generated "knowledge stock" comes from:

- "*the interplay between universities and industry and what this contributes to the governance of these institutions*;
- *the collective learning mechanisms which emerge when universities, industry and government bodies act together in searching for efficient public management solutions*;
- *the "thickness" of the institutions participating in the innovation process, along with the products this creates as a means to serve the social needs, cultural requirements and environmental values of the urban and regional innovation system*;
- *the interaction between university and industry*;
- *the interplay between university, industry and government in what here is labeled 'learning'*;
- *an efficient market, based on well-defined rules and functioning institutions that not only guarantees cooperation between the independent and state sectors, but which also enhances the interrelations among universities, industry and government in those places where knowledge is produced*" (Deakin, 2018, pp. 13–14).

Table 1 Smart cities determinants and factors

Smart governance	Smart people	Smart living	Smart mobility	Smart economy	Smart environment
Participation in decision-making	Level of qualification	Cultural facilities	Local accessibility	Innovative spirit	Lack of pollution of natural conditions
Public and social services	Affinity to lifelong learning	Health conditions	(Inter-)national accessibility	Entrepreneurship	Pollution
Transparent governance	Social and ethnic plurality	Individual safety	Availability of ICT-infrastructure	Economic image & trademarks	Environmental protection
Political strategies & perspectives	Flexibility	Housing quality	Sustainable, innovative and safe	Productivity	Sustainable resource management
	Creativity	Education facilities	Transport systems	Flexibility of labour market	
	Cosmopolitanism/Open-mindedness	Touristic		International embeddedness	
	Participation in public life	Social cohesion		Ability to transform	

Source Adapted from Giffinger and Gudrun (2010)

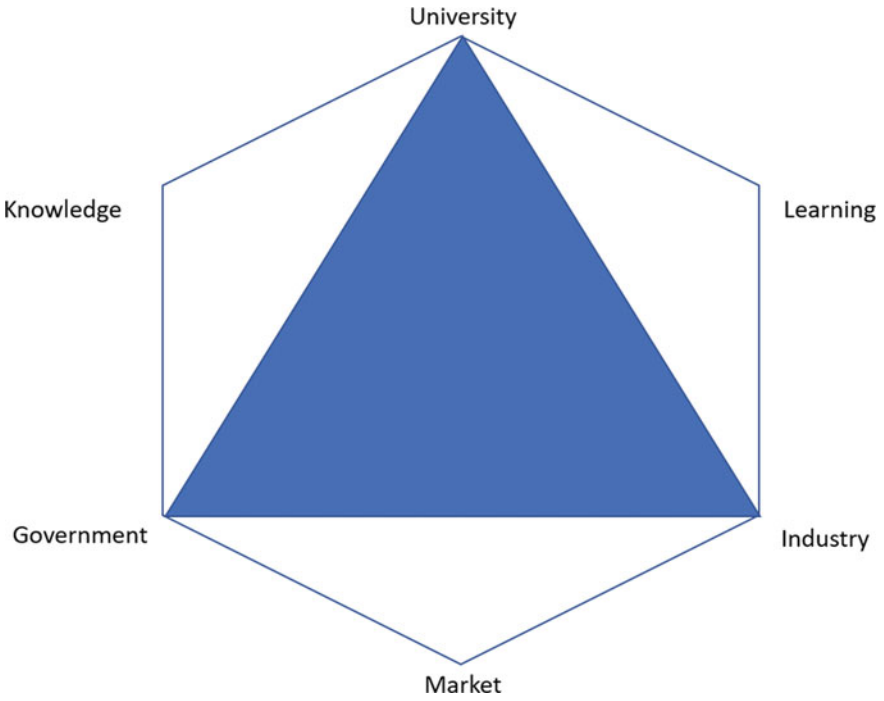

Fig. 2 Advanced triple helix model for smart cities. *Source* Adapted from Lombardi et al. (2012)

3 Evolution and Determinants of Social Business Cities

Yunus provided early hints of the vision for Social Business Cities in his 2010 book with Karl Weber, *Building Social Business*, in which he described how creative individuals and groups will launch social businesses to meet social needs, including in areas typically served by government, such as utilities, healthcare, education, transport. While Yunus and Weber do not appear to explicitly use the term "Social Business City" in that book, they provide a foundational call for such administrative areas, arguing that social businesses may provide typical government services more efficiently, particularly in light of extensive corruption or control of governments by special interests. Furthermore, while delivery of social services by social businesses may appear to be similar to the privatization of such services in recent years, Yunus and Weber (2010:24) argued that unlike privatization efforts characterized by nepotism and self-interest, social businesses are unique because they are specifically focused on "serving the needs of the people".

Over the last decade since Yunus and Weber (2010) implicit call for Social Business Cities, a number of cities around the world have adopted the title "Social Business City." A review of literature on the topic suggests there

are now seven Social Business Cities in Europe and Asia, including Wiesbaden, Germany (Anderson, 2020; Jiménez, 2014; Social Business: Women, 2019; Summer of Purpose, 2020; Wirtz & Volkmann, 2015a, b; Wirtz, 2017; YY Foundation, 2019), Fukuoka, Japan (Daily Star, 2011; SocialBusinessPedia, 2020; The Yunus and Shiiki Social Business Research Center, n.d.), Pistoia, Italy (Yunus Centre, 2017; Yunus Social Business Center University of Florence 2020b, c), Barcelona, Spain (Social Business City Barcelona, 2016, 2018; Yunus Social Business Center University of Florence 2020d, e), Ipoh, Malaysia (MyHarapah, 2017; SocialBusinessPedia, 2016), Taoyuan, Taiwan (Yunus Social Business Center University of Florence, 2020f), and possibly Rio, Brazil (SocialBusinessPedia, 2014), and implicitly Paris, France (Etchells, 2020; Paris, 2024, 2020).

Wiesbaden, Germany, is widely noted as the first Social Business City in 2010 and is the focus of research by several scholars, including Jiménez (2014), Wirtz and Volkmann (2015a, b), and Wirtz (2017). Social businesses in Wiesbaden have flourished and are active, including the Grameen Creative Lab, Social Business: Women (2019; Anderson, 2020), besides support organizations including the Danone-funded Chair of Social Business at EBS University (n.d.; Anderson, 2020) and the "Wiesbaden Foundation" (Anderson, 2020). Furthermore, social business community work initiated in Wiesbaden appears to have expanded worldwide, as other cities have become Social Business Cities and as the Grameen Creative Lab and the YY Foundation (2019) support networking efforts and scholarly conferences of social business actors and scholars around the world (Summer of Purpose, 2020).

Fukuoka, Japan, became the second Social Business City in 2011 (Daily Star, 2011), in partnership with numerous collaborators, including Kyushu University of Japan. The Yunus and Shiiki Social Business Research Center (n.d.) was also established at Kyushu University in 2011. In 2012, a $20 million Social Business Fund for Japan was announced at the 3rd Social Business Forum Asia, which was hosted by the Yunus and Shiiki Social Business Research Center at Kyushu University (SocialBusinessPedia, 2020).

Pistoia, Italy, was declared a Social Business City on 11 July 2012 (Yunus Centre, 2017; Yunus Social Business Center University of Florence 2020b, c) and appears to be supported in its work by the Yunus Social Business Center University of Florence.

Social Business City Barcelona (2016) as an organization was created in 2016 and is one of the star Social Business Cities, posting annual activity reports starting in 2014, financial reports starting in 2016, and social balance sheets starting in 2018 (Social Business City Barcelona, 2018); furthermore, it boasts collaboration with numerous universities and has an extensive network of active social businesses (Yunus Social Business Center University of Florence 2020d, e).

Ipoh, Malaysia, became a Social Business City in 2016 in a joint declaration by the State of Perak, Malaysia, the City of Ipoh, the of MyHarapan, a youth organization of Malaysia, and Yunus Centre (SocialBusinessPedia, 2016). Following its launch as a Social Business City, Ipoh continued its work with support for social business bootcamps and education efforts, particularly in collaboration with the MyHarapan youth organization (MyHarapah, 2017).

Taoyuan, Taiwan, became a Social Business City in 2018 and in partnership with the National Central University of Taiwan. Taoyuan, while having only recently become a Social Business City likewise showcases an impressive list of social businesses and academic partnerships (Yunus Social Business Center University of Florence 2020f).

According to SocialBusinessPedia (2014), Rio was declared a Social Business City in 2014; however, English-language reports or updates on that status are scant.

One notable development in cities committing to social businesses is Paris2024. In preparation for the Summer and Paralympics of 2024 which will be hosted in Paris, the city has "committed to organising an event that is socially responsible and economically sound right from the bidding phase" (Paris, 2024, 2020) This commitment is ensured already in the construction phase, in which 25% of building contracts are allotted to very small enterprises, small and medium-sized enterprises, and social and solidarity economy enterprises. dedicated to (Etchells, 2020).

Social Business Cities appear to be driven by a synergy of universities, city governments, social businesses, and civil society organizations. The empirical determinants of social businesses derived from observed cases can also be supported by determinants mentioned in literature. Thus, relying on the work of Jimenez (2014), and building on the cases surveyed above and new emergent ones such as the city of Tirana (capital of Albania), common features or determinants can be drawn in order to build a Social Business City (SBC).

At first place, an SBC cannot exist without the presence of *social businesses* which are the engine behind the SBC movement. Involving numerous viable social businesses, as appears to be the case in Barcelona and Taoyuan, seems to help sustain an ongoing, active focus on Social Business.

However, SBs themselves have some preconditions for formation and effective functioning. For example, a diagnosis of *social needs* is necessary. These are social problems to be transformed into social business opportunities which satisfy pressing needs (e.g. unemployment, poverty, health, carbon emissions, etc.). For this purpose, a business plan is crucial. There are different templates for *planning a social business*, but one of the most completed is provided by the Center for Social Innovation and Social Entrepreneurship Hub at Stanford University (https://sehub.stanford.edu/pro-1). The Social Business Model Canvas can be appropriate also for designing Social Business Cities since it is *network-centric* based on actor-to-actor relationships and *value co-creation* (Wieland et al., 2012). The network can comprise community (of citizens and potential customers), educational institutions (mainly universities and research institutes; still, not to be underestimated high schools which can elaborate a social business mindset of pupils), social investors, the city itself (in the institutional sense, represented by the municipality and other local institutions of public administration), civil society organizations and international ones (including focal points and mediators) as generators/implementers of programs/projects, traditional and social media, and any other possible stakeholder.

Through social businesses, a city must make a *social impact* to be rigorously *assessed*. Some areas of impact are social, economic, environmental, and cultural. An excellent example of a SBC with measured social impact is Barcelona. Social

Business City Barcelona (2016) has posted annual activity reports starting in 2014, financial reports starting in 2016, and social balance sheets starting in 2018 (Social Business City Barcelona, 2018); furthermore, it boasts collaboration with numerous universities and has an extensive network of active social businesses (Yunus Social Business Center University of Florence 2020d, e). Pompeu Fabra University Barcelona (n.d.), through an online course offered via FutureLearn, recommends that for each area of impact an analysis must be made considering three layers: social accomplishments (e.g. number of service users); demonstrated social impact (e.g. increased awareness); monetized impact (e.g. saved costs). Based on collected data, the Social Return on Investment (SROI) can be used for measuring the impact as follows: SROI = (Social impact value – initial investment)/initial investment.

A *hub* representing an operational structure and a governing body is relevant for coordinating activities in the city. For example, in the emerging SBC of Tirana, though in its embryonic phase, this role is played by Yunus Center for Social Business and Sustainability at EPOKA University and Yunus Social Business Balkans. These two entities, besides the academic and financial operations, put great efforts on incubating activities. Therefore, the incubator is a fundamental unit to promote social businesses and transform a city into an SBC.

The *city* itself is the membrane which is supposed to include social business cells. To date, SBCs as recognized entities do not appear in the face of hostility from government; rather, they are created in collaboration with government entities. Social businesses likely do offer valuable services in cities that are not recognized as SBCs. Such cities may approach the spirit of Yunus and Weber's call in 2010 but not achieve recognition because of the lack of government interest in doing so. For example, although Albania has several social businesses, no Albanian city appears to have yet sought or earned the title Social Business City.

Likewise, there are city governments that are highly supportive of social enterprise but may operate outside the Yunus network of SBCs. The Social Enterprise Places, including Social Enterprise Cities of the UK (Social Enterprise UK, 2020), are an example of this. Paris is an example of a city with a deep commitment to SBs and which is partnering with the Yunus Center to deliver Paris2024, but which does not appear to have the title of an official SBC. Besides government, other stakeholders in the city can also play important roles. For example, in Malaysia, the youth organization, MyHarpan, seems to be most active in pushing forward with promoting Social Businesses.

Furthermore, SBCs must communicate their vision and work for promotional and accountability purposes. So, *traditional and social media* can be important *communication channels* to share what happens around the city. In this way, social business stamina remains active and stimulates new social investors and other stakeholders to jump-in and reinforce the image of a social business city. Barcelona stands out as an example with particularly effective communication (e.g. Social Business City Barcelona, 2018).

Finally, SBCs do take a great deal of work and ongoing *commitment* from stakeholders. For example, a Facebook group for Social Business City Wiesbaden was

Table 2 Social business cities determinants and factors

Social businesses	Social impact	Hub	City	Communication	Sustainability
Social needs	Social accomplishments	Coordinator/governing Body	Governance	Social media	Long-term commitment
Planning	Demonstrated social impact	Operational structure	Local authorities	Traditional media	Resilience
Value co-creation	Monetizing the impact	Incubation	Legislation		
	Measurement (e.g. SROI)	Relationship & networks			

very active for several years, but its last post is from 2016, suggesting the energies of participants was directed elsewhere after half a decade. Pistoia, Rio, and Ipoh have likewise earned the name Social Business City, but activity under that name seems to have waned. Some cities may refocus on new developments. For example, one of the first Social Business Cities, Fukuoka, appears to focus more widely on startups (Startup City Fukuoka, 2020), indicating that the city is focusing on the wider startup ecosystem. Thus, long-term commitment and resilience create the conditions for sustainability.

In summary, SBCs require persistent collaboration from stakeholders, including social businesses, measures of social impact, hubs, governing authorities, effective communication, and sustainability, as summarized in Table 2.

4 Building Smart-Social Business Cities: A Reflective Discussion on a Conceptual Framework

The conceptual model constructed in this study aims to visually represent the theoretical concepts of interest for this study, here represented as determinants for each of the two broad theoretical constructs under investigation. A major reason behind this study is that the smart city concept is already a hot topic and becoming every day more popular, in this context the researchers of this study believe that socially aware and sustainable policies should become a norm while designing different smart city projects or other plans that affect the future of the world. The rapid urban population growth phenomena requires a sustainable and balanced urban development strategy that does not neglect social dynamics policies which are vital in affecting the livability and wellbeing in the to-be established smart cities. So, conceptually speaking smart cities of the future should be designed and built for a comprehensive, sustainable and balanced development or growth. This study, rather than recognizing differences or looking for a relationship between theoretical constructs, originally aimed to explore common ground between namely the Smart City concept and Social Business philosophy, given the growing discussion on the social dimensions and related challenges of the smart city (e.g. Visvizi & Lytras, 2020) (Fig. 3).

Fig. 3 Smart-social business city

After having conducted a thorough literature review on studies around these two concepts the researchers have discovered and clustered core determinants that define each of the above-mentioned theoretical constructs. It results that determinants of Smart City and Social Business concepts have many common features which drove the researchers towards further investigating the possible integration of these two concepts and deriving a conceptual model named as the Smart-Social City model.

Regarding the smart city concept, there is consensus among scholars that scoring high in 'smart city' criteria has a positive impact in improving the quality of life for members of a specific community and furthermore, a multi-stakeholder approach of various 'actors' from a balanced urban ecosystem generate greater and more sustainable economic development through a co-creation approach of these 'actors' that could be people, technology, and institutions. From this point of view, researchers of this study concluded that a smart city could be more sustainable if it further integrated with the Social Business philosophy. Thus, the call for Smart-Social Business Cities (SSBC) is a natural evolution of both cities and the business ecosystem, with the latter representing the main development engine of cities in general.

The Smart-Social Business City model integrates both determinants of the Smart City concept and the Social Business construct. This integration should not be perceived as hierarchical and/or a 'fixed point-in-time' clustering rather it should be

analyzed as an ever-shifting inter-relationship between the determinants of both theoretical constructs elaborated here. In this context, it results that the 'smart governance' and 'smart environment' determinants of the Smart City construct, closely related to the engagement of various stakeholders in decision-making and public services stimulating a sustainable city growth and high quality of life through safe, secure environmentally green, and efficient urban spaces could be clustered at a large extent under the 'city' determinant of the Social Business construct. The 'smart living' determinant, usually associated with ICT-enabled lifestyles (Arasteh et al., 2016), behaviour and consumption, related to high levels of social cohesion and social capital together with the 'smart governance' are partially clustered under the 'hub' determinant of the Social Business construct. Similarly, better-educated individuals and skilled workforces and Smart People are the protagonists of a smart city, shaping it through continuous interactions and benefiting from its social capital and together with the 'smart living' determinant mentioned above are partially clustered under the 'sustainability' determinant of Social Business. Furthermore, the 'smart mobility' determinant of the Smart City stands for sustainable, safe and interconnected transportation and logistics options that prioritise improving community service by saving time and costs. This determinant together with the 'smart people' determinant mentioned above seem to partially cluster under the 'social impact' determinant of the Social Business. The 'smart economy' component of Smart City calls for ICT-enabled innovation, high productivity, knowledge-intensive jobs and sustainability-oriented initiatives among others. From the other side the 'social businesses' determinant of the Social Business approach calls for value co-creation among different stakeholders of the business ecosystem and beyond. In this context the 'smart economy' determinant together with 'smart environment' determinant defined above seem to be clustered under the 'social businesses' component of the Social Business philosophy.

The Smart-Social City conceptual model represents a model that integrates sustainability principles to the smart city concept by introducing the Social Business philosophy as an overarching theoretical framework. This overarching approach is critical in designing smart cities that are, above-all, sustainable for the constituents of those smart cities.

5 Implications and Recommendations

This research comes up with many contributions having crucial theoretical and practical implications. First of all, the study brings a new multidimensional perception and definition of the city to all its stakeholders and researchers, by advocating that a city should not be a smart or a social business one, but both concepts should be incorporated in the city for its development and sustainability. This study is a pioneer bringing this merged concept to the attention of policymakers, practitioners, and scholars.

This study contributes to the implementation of the Smart-Social Business Cities (SSBC) through the proposed framework, and calls on policymakers to engage in

quality planning development, create appropriate infrastructure and technological support, provide financial support and subsidize universities, incubators, and start-ups that contribute to further SSBC solutions.

The findings of this chapter encourage entrepreneurs building business models dealing with technology as a means for achieving sustainable development not as an end; co-creating value among city ecosystem stakeholders by considering urban, economic, environmental, and social needs altogether. Moreover, the study brings to the attention the immediate need on the recognition of users‘ expectations and preferences also related to issues such has well-being and happiness.

Moreover, this enquiry acknowledges the importance of the Advanced Triple Helix collaboration among university—government—industry as a crucial promoter and developer of the SSBC. This process cannot be carried out beyond the society‘s support on advocating and campaigning on its reciprocal benefits. Furthermore, this model provides also metrices on measuring the cities performances beyond the informatics of digital infrastructures and focus on the responsibilities towards the community of stakeholders they affect.

Likewise, this study encourages further research on guiding principles of SSBCs and advocates their adoption by public and private decision makers. At the same time this research attracts smart and social business cities scholars explore further procedures necessary for the SSBC development, functioning and its performance evaluation on the urban, social, economic, and environmental aspects.

From this research, two main recommendations intended for both scholars and practitioners are made using classical frameworks from the literature of business and economics.

A first one is by placing the determinants found in our conceptual framework within PESTEL Analysis. Therefore, by incorporating determinants and the items of each determinant within the building blocks of PESTEL (i.e. politics, economy, society, technology, environment, law), policy makers, businesses, and other actors—depending on the city dynamics and their own perspective—can make use of PESTEL for creating Smart-Social Business Cities.

A second recommendation is directly related with the Triple Bottom Line approach of sustainability, or the approach “people-planet-profit” (Elkington, 1997). It sounds reasonable to safeguard the actual and future prosperity of society, environment, and economy while developing Smart-Social Business Cities. Indeed, it is a mission per se of Smart-Social Business Cities to develop the sustainability agenda. Consequently, determinants and items presented in this research can be categorized also under economic, social, and environmental dimensions of sustainability. Guidelines from UN Global Compact and Global Reporting Initiative can be helpful for designing the mentioned framework.

6 Conclusions

While cities around the world are taking a smart shape, it is deemed necessary that the main promoter of this shape (i.e. the business enterprise) takes a social direction. Thus, the city better represents its population through simultaneous technological development, human-centeredness, and environmental protection. The call for Smart-Social Business Cities is a natural evolution of both cities and businesses, with the latter representing the main development engine of cities. For instance, it is possible to use social businesses as catalysts of a smart economy and smart environment. Likewise, a good hub and a functional communication platform can ease the process of building smart people and living, smart mobility, and a smart government.

The topic developed in this research is embryonal when it comes to consider both smart cities (SC) and social business cities (SBC). Through the constructed model, based on SC and SBC determinants, researchers, policy makers, and many other stakeholders can benefit from its applications. Furthermore, it is hoped that this conceptual model serves as a starting point or a guide for new frontiers of research in this aspect.

References

Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart cities: Definitions, dimensions, performance, and initiatives. *Journal of Urban Technology, 22*(1), 3–21.

Anderson, S. (2020) NexThought monday: What makes a 'Social Business City'. *NextBillion.* Available from: https://nextbillion.net/nexthought-monday-what-makes-a-social-business-city/

Arasteh, H., Hosseinnezhad, V., Loia, V., Tommasetti, A., Troisi, O., Shafie-khah, M., & Siano, P. (2016). Iot-based smart cities: A survey. In *2016 IEEE 16th international conference on environment and electrical engineering (EEEIC)* (pp. 1–6). IEEE.

Caragliu, A., Del Bo, C., & Nijkamp, P. (2011). Smart cities in Europe. *Journal of Urban Technology, 18*(2), 65–82.

Ciasullo, M. V., Troisi, O., Grimaldi, M., & Leone, D. (2020). Multi-level governance for sustainable innovation in smart communities: an ecosystems approach. *International Entrepreneurship and Management Journal*, 1–29.

Cisco (2012). *Smart city framework: A systematic process for enabling smart+connected communities.* San Jose: Cisco

Deakin, M. (2014). Smart cities: The state-of-the-art and governance challenge. *Triple Helix, 1*(1), 1–16. https://doi.org/10.1186/s40604-014-0007-9

Deakin, M. (2018). Smart cities, metrics and the future internet-based governance of urban and regional innovations. *Scienze Regionali*, *17*(1).

Deloitte (2018). The rise of the social enterprise. *Deloitte global human capital trends.* Available from www2.deloitte.com/content/dam/insights/us/articles/HCTrends2018/2018-HCtrends_Rise-of-the-social-enterprise.pdf

EBS Universität (n.d.). *Chair of social business.* Available from: https://www.ebs.edu/en/institution/chair-of-social-business/research

Elkington, J. (1997). *Cannibals with Forks: The triple bottom line of 21st century business.* New Society Publishers.

Etchells, D. (2020). Solideo holds meeting between builders of Olympic equipment as Paris 2024 preparations continue. *Insidethegames.biz.* [Online] 5 March. Available from: https://www.insidethegames.biz/articles/1091430/solideo-olympic-equipment-paris-2024

European Parliament (2014). *Mapping smart cities in the EU*. Directorate general for internal policies, Policy department A: Economic and scientific policy. IP/A/ITRE/ST/2013–02. PE 507.480. Available from: https://www.europarl.europa.eu/RegData/etudes/etudes/join/2014/507480/IPOL-ITRE_ET(2014)507480_EN.pdf

Friedmann, J. (1986). The world city hypothesis. *Development and Change, 17*, 69–83. https://doi.org/10.1111/j.1467-7660.1986.tb00231.x

Giffinger, R., & Gudrun, H. (2010) Smart cities ranking: an effective instrument for the positioning of the cities? *ACE: Architecture, City and Environment*, *4*(12), 7–26.

Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanovic, N., & Meijers, E (2007). *Smart cities—Ranking of European medium-sized cities.* [Report]. Vienna University of Technology. Available from: http://www.smart-cities.eu/download/smart_cities_final_report.pdf

Hollands, R. (2008). Will the real smart city please stand up? *City, 12*(3), 303–320. Available at: https://researchdirect.westernsydney.edu.au/islandora/object/uws:30908

Hysa, X., Zerba, E., Calabrese, M., & Bassano, C. (2018). Social business as a sustainable business model: Making capitalism antifragile. *Sustainability Science, 13*(5), 1345–1356. https://doi.org/10.1007/s11625-018-0566-1

IBM. (2009). *A vision of smarter cities.* IBM Institute of Business Value.

Jiménez A. F. J. (2014). Social business city: Lessons from Wiesbaden. In A. Grove & G. Berg (eds.), *Social business* (pp. 115–138). Berlin, Heidelberg: Springer. https://doi.org/10.1007/978-3-642-45275-8_8

Kourtit, K., Nijkamp, P., & Arribas, D. (2012). Smart cities in perspective–a comparative European study by means of self-organizing maps. *Innovation: The European journal of social science research*, *25*(2), 229–246.

Lombardi P., Giordano S., Caragliu A., Del Bo C., Deakin M., Nijkamp P., & Kourtit K. (2011). An advanced Triple-Helix network model for smartcities performance. *Research Memorandum*, *45*

Lombardi, P., Giordano, S., Farouh, H., & Yousef, W. (2012). Modelling the smart city performance. *Innovation: the European Journal of Social Science Research*, *25*(2), 137–150.

Lytras, M. D., Visvizi, A., & Sarirete, A. (2019). Clustering smart city services: Perceptions. *Expectations, Responses, Sustainability, 11*(6), 1669. https://doi.org/10.3390/su11061669

MyHarapan (2017). *Updates on social business city Ipoh.* Available from: https://myharapan.org/__trashed/

Paris2024 (2020). *Integrating the social and solidarity economy.* Available from: https://www.paris2024.org/en/integrating-the-social-and-solidarity-economy/

Pompeu Fabra University Barcelona (n.d.). *Social business: A sustainable way to face the most pressing needs of our time*. FutureLearn. Available from: https://www.futurelearn.com/courses/social-business

Sassen, S. (1991). *The global city*. Princeton University Press.

Schaffers, H., Komninos, N., Tsarchopoulos, P., Pallot, M., Trousse, B., Posio, E., Fernadez, J., Hielkema, H., Hongisto, P., Almirall, E., & Bakici, T. (2012). *Landscape and roadmap of future internet and smart cities.* Hal-00769715 [Technical Report] p. 222. Available from: https://hal.inria.fr/hal-00769715/document

Social Business City Barcelona (2016). *Statues of association.* Available from: https://www.sbcbarcelona.org/wp-content/uploads/2018/06/Estatuts-Associacio%CC%81-SBC.pdf

Social Business City Barcelona (2018). *Transparencia.* Available from: https://www.sbcbarcelona.org/qui-som/#transparencia

Social Business: Women (2019). *Unsere standorte: Wiesbaden.* Available from: https://www.social-business-women.com/unsere-standorte/wiesbaden/

SocialBusinessPedia (2014). *Brazil.* Available at: http://socialbusinesspedia.com/wiki/details/134/brazil

SocialBusinessPedia (2016). *Ipoh declared first Social Business City in Malaysia.* Available from: http://socialbusinesspedia.com/news/details/386/Ipoh-declared-first-Social-Business-City--in-Malaysia

SocialBusinessPedia (2020). *Japan social business fund announced.* Available from: http://socialbusinesspedia.com/news/archive-details/112/Japan-Social-Business-Fund-Announced

Startup City Fukuoka (2020). *Startup City Fukuoka.* Available from: https://startup.fukuoka.jp/

Summer of Purpose (2020). *Colloquium 51 essentials.* Available from: https://www.summerofpurpose.com/fileadmin/user_upload/PDF_Downloads/20200803_Conclusio_Colloquium_51.pdf

The Daily Star (2011). Fukuoka: Second social business city. *The Daily Star.* [Online] 27 July. Available from: https://www.thedailystar.net/news-detail-195838

United Nations, Department of Economic and Social Affairs Population Division (2014) *The world population situation in 2014: A concise report*. pp.1–38. NY, ST/ESA/SER.A/354.

Vienna University of Technology (2015). *European Smart Cities 4.0.* Available from http://www.smart-cities.eu/?cid=-1&ver=4

Visvizi, A., & Lytras, M. D. (2018). Editorial: Policy making for smart cities: Innovation and social inclusive economic growth for sustainability. *Journal of Science and Technology Policy Management (JSTPM), 9*, 126–133.

Visvizi, A., & Lytras, M. D. (2020). Sustainable smart cities and smart villages research: Rethinking security, safety, well-being, and happiness. *Sustainability, 12*(1), 215.

Wieland, H., Polese, F., Vargo, S. L., & Lusch, R. F. (2012). Toward a Service (Eco) systems perspective on value creation. *International Journal of Service Science, Management, Engineering, and Technology (IJSSMET), 3*(3), 12–25. https://doi.org/10.4018/jssmet.2012070102

Winters, J. V. (2011). Why are smart cities growing? Who moves and who stays. *Journal of Regional Science, 51*(2), 253–270.

Wirtz, M., & Volkmann, C. (2015). Do social business cities foster sustainable urban development? *Social Business, 5*(2), 157–175.

Wirtz, M., & Volkmann, C. (2015). Social entrepreneurial ecosystems as a means for creating sustainable urban development. In J. Condie & A. M. Cooper (Eds.), *Dialogues of sustainable urbanisation: Social science research and transitions to urban contexts* (pp. 275–277). University of Western Sydney.

Wirtz, M. (2017). *Social business innovations*. [Unpublished doctoral dissertation]. Schumpeter School of Business and Economics, Faculty of Economics, University of Wuppertal. Available from http://elpub.bib.uni-wuppertal.de/servlets/DerivateServlet/Derivate-7765/db1802.pdf https://core.ac.uk/download/pdf/159621177.pdf

Yoshikawa Y., Sato A., Hirasawa S., Takahashi M., & Yamamoto M. (2012). Hitachi's vision of the smart city. *Hitachi Review*, *61*(3). Available at: https://www.hitachi.com/rev/pdf/2012/r2012_03_all.pdf

Yunus & Shiiki Social Business Research Center (n.d.). *About Yunus & Shiiki Social Business Research Center (SBRC).* Available at: https://sbrc.kyushu-u.ac.jp/113931.html

Yunus, M. (2017). *A world of three zeros: The new economics of zero poverty, zero unemployment, and zero net carbon emissions.* Public Affairs.

Yunus, M., & Weber, K. (2010). *Building social businesses: The new kind of capitalism that serves humanity's most pressing needs*. Public Affairs.

Yunus Centre (2017). Italian city Pistoia declared as Social Business City. *SocialBusiness-Pedia.* Available from: http://socialbusinesspedia.com/news/archive-details/110/Italian-City-Pistoia-Declared-as-Social-Business-City

Yunus Social Business Center University of Florence (2020c) *What has been going on in Pistoia Social Business City?* Available from: http://sbflorence.org/en/in-pistoia-social-business-city/

Yunus Social Business Center University of Florence (2020e). *What has been going on in Barcelona Social Business City?* Available from: http://sbflorence.org/en/in-barcelona-social-business-city/

Yunus Social Business Center University of Florence (2020b). *Pistoia social business city*. Available from: http://sbflorence.org/en/portfolio/pistoia-social-business-city/

Yunus Social Business Center University of Florence (2020d). *Barcelona social business city.* Available from: http://sbflorence.org/en/portfolio/barcelona-social-business-city/
Yunus Social Business Center University of Florence (2020f). *Taoyuan social business city.* Available from: http://sbflorence.org/en/taoyuan-social-business-city/
YY Foundation (2019). *Academia report on social businesses 2019.* Available from: http://yyfoundation.com/?fbclid=IwAR3gDqysMCHOEEqN2WB_eK5sUt8bOHZqdfcz9Qjm7f733EvgTRJDFLkRNNs

Xhimi Hysa Ph.D., Associate Professor, EPOKA University, Tirana, Albania. His research interests include viable Systems Approach, Social Business, Sustainability, Service Science, Group Dynamics.

Alba Kruja Ph.D., Lecturer, EPOKA University, Tirana, Albania. Her research interests include entrepreneurship, innovation, small business management, social business.

Timothy Hagen Ph.D., Lecturer, EPOKA University, Tirana, Albania. His research interests include international economics and cultural affairs, international family and community studies, social business.

Esmir Demaj Ph.D., Lecturer, EPOKA University, Tirana, Albania, His research interests include operations research, project management, dynamic capabilities, social business.

Managing Participation, Representation and Co-creation in the Smart City

Social Accountability of Local Governments in Smart Cities: A Multiple Case Study

Francesca Loia and Gennaro Maione

Abstract Over the years, the international standards for promoting SA-oriented behaviors have been undergoing continuous changes and updates to ensure an appropriate adaptation to the turbulences caused by the emergence of new social events and happenings. This trend, emerging at the level of operating practice, is confirmed by the growing interest in SA expressed by Public Accounting and Management scholars. However, the analysis of the literature highlights the poor attention paid in the study of the SA of LGs involved in smart city projects, although the latter are revolutionizing the way of life of citizens in many countries all over the world. Based on these considerations, the work aims to provide answers to two Research Questions: RQ_1: "*How ICT-enhanced services and applications for smart cities allow the local governments to be more socially accountable?*"; RQ_2: "*How ICT-enhanced services and applications for smart cities allow the local governments to track the accountability of the stakeholders involved in the administration/management of smart cities?*". The study is based on the analysis of the answers provided by a sample of 56 managers employed in some Italian municipalities involved in smart city projects. The questions were prepared in the form of semi-structured interviews, developed by listing the key variables related to the SA from the Public Management literature: participation; transparency; and monitoring. The results of the analysis suggest that, in addition to the three variables identified in the literature, it is necessary to invest in the stakeholders' involvement through the implementation of strategies oriented towards Open Data Governance.

Keywords Social accountability · Public accounting and management · Local government · Smart city · Qualitative research · Interviews · Multiple case study

F. Loia
Department of Economics, Management and Institutions, University of Naples 'Federico II', Naples, Italy
e-mail: francesca.loia@unina.it

G. Maione (✉)
Department of Business Science—Management & Innovation Systems, University of Salerno, Fisciano, Italy
e-mail: gmaione@unisa.it

A. Visvizi and O. Troisi (eds.), *Managing Smart Cities*,
https://doi.org/10.1007/978-3-030-93585-6_10

1 Introduction

Social Accountability (SA) represents one of the most important requirements through which Local Governments (LGs) can show stakeholders their commitment to respect precise ethical constraints and responsibility for the goals pursued, the policies adopted, and the decisions taken (Brinkerhoff & Wetterberg, 2016). Over the years, the international standards for promoting social accountability-oriented behaviors have been undergoing continuous changes and updates to ensure an appropriate adaptation to the turbulences caused by the emergence of new social events and happenings (Joshi & Houtzager, 2012). This trend, emerging at the level of operating practice, is confirmed by the growing interest in SA expressed by Public Accounting and Management scholars. However, the analysis of the literature highlights the poor attention paid in the study of the social accountability of LGs involved in smart city projects, although the latter are revolutionizing the way of life of citizens (Ciasullo et al., 2020; Visvizi et al., 2018) in many countries all over the world (Lytras & Visvizi, 2018; Lytras et al., 2019; Willems et al., 2017). This literature gap underlines the research problem of this study, suggesting moving away from the traditional domain of public administration at the local level, that is "administering city", to the need—and opportunity—to identify and exploit possible synergies and solutions that the ICT-enhanced services and applications specifically focused on the "smart city management". In light of these considerations, the work aims to provide answers to the following two Research Questions:

RQ$_1$: *How ICT-enhanced services and applications for smart cities allow the local governments to be more socially accountable?*

RQ$_2$: *How ICT-enhanced services and applications for smart cities allow the local governments to track the accountability of the stakeholders involved in the administration/management of smart cities?*

To meet this knowledge requirement, this study follows a qualitative investigation approach (Dumay & De Villiers, 2019), based on the analysis of the answers provided by a sample of 56 managers employed in some Italian municipalities involved in smart city projects. The questions were prepared in the form of semi-structured interviews, developed by listing the key variables related to the social accountability from the Public Management literature: participation; transparency; and monitoring. The results of the analysis suggest that, in addition to the three variables identified in the literature, it is necessary to invest in the stakeholders' involvement through the implementation of strategies oriented towards Open Data Governance (Troisi, 2016; Troisi et al., 2020), capable of highlighting the actual benefits deriving from the synergic collaboration among LGs and stakeholders. In this sense, the study provides several insights, potentially capable of generating useful implications for both researchers and professionals in the public sector.

The stated objective was pursued by structuring the work into the following further sections: (2) theoretical background, focused on the analysis of previous studies dedicated to Social Accountability for Local Governments, with a deepening about smart cities; (3) research design, related to the methodology used for the construction

and administration of the interviews, sampling and data collection; (4) discussion of the results arising from the analysis of the answers obtained; (5) Theoretical-managerial implications and conclusive considerations about the limits of the work and the ideas for future research.

2 Theoretical Background

2.1 Social Accountability for Local Governments and City Management

SA represents one of the first and most important requirements through which LGs can demonstrate their social commitment (Clune & O'Dwyer, 2020). The issue of accountability arises and takes root in various sectors of civil society, thus meeting the protection needs that our time requires (O'Dwyer & Unerman, 2007). The concept of "accountability" is often compared to that of responsibility, although the two terms are not synonymous. In fact, accountability has a broader meaning, which refers to two distinct elements: the desire to give account to stakeholders in an exhaustive and understandable way about the correct use of resources and the production of results in line with institutional purposes; the need to introduce logic and mechanisms for greater internal accountability of local authorities in relation to the use of these resources and the production of related results.

Although at the end of the previous century, the social accountability was already a well-known and widely debated topic (Gray et al., 1988; Parker, 1991), it obtained its first official recognition in 2012, when it was established as an element of privacy and data protection, to the point of becoming a relevant aspect of Regulation proposal put forward by the European Commission; in 2016, EU Regulation 2016/679 finally was enacted and, with reference to accountability, Article 24 established that the data controller is required to adopt policies and implement adequate measures to guarantee and be able to demonstrate that the processing of personal data has occurred in compliance with the Regulation itself (Boyce & Davids, 2009).

Over the years, the concept of SA has expanded and evolved, assuming, in the last decade, a central role in the economy of public administrations and, more specifically, of LGs and city management (O'Sullivan & O'Dwyer, 2015). This diffusion derives from the consideration according to which, every time "non-own" resources are used to carry out certain activities, it is necessary to report to third parties for the choices made (Dunleav & Hood, 1994; Laufer, 2003). However, despite the centrality of accountability, this issue has not yet been studied sufficiently from a theoretical and practical point of view; it is at the center of the studies and reform strategies of public city management at an international level (Parker, 2011; Ciasullo et al., 2017; Polese et al., 2018, 2017; Mele et al., 2012) and today, in most countries, accountability systems oriented towards a performance logic are being developed, according to which the social accountability contributes to improving effectiveness

of city management and the efficiency of public administrations (Joshi & Houtzager, 2012). Starting from the centrality of citizens and their right to obtain immediate access to information that allows evaluating the work of the Public Administration, SA responds to the need to ensure greater quality and appropriateness of administrative action for city management (Lytras & Visvizi, 2020), in order to avoid climate of undifferentiated controversy towards politics or institutions and the simple regulatory or bureaucratic reorganization (Brinkerhoff & Wetterberg, 2016). Social accountability consists of at least three elements, the so-called "pillars": transparency, participation, and monitoring.

Transparency translates into complete accessibility to information for citizens and, more generally, all stakeholders, even as users of the service. Transparency includes the provision of tools aimed at making decisions, actions, performance, and results of administrations in terms of city management more visible, as well as the expansion of the governance of local public bodies and services to the inclusion of citizens' and consumer organizations (Lytras et al., 2020a, 2020b; Read & Atinc, 2017; Visvizi et al., 2017). Transparency is a fundamental indicator for assessing public utility services and the degree of efficiency of any body that is committed to providing them (Cassano, 2017; Ciasullo & Troisi, 2013; Malena et al., 2004). The effectiveness of a service and its evaluation necessarily passes through the transparency of city management processes, that is the information provided to citizens who use that service, the transparency of the procedures for accessing it and the information provided at all stages of the procedure (Schmidt & Wood, 2019).

Participation indicates the institution's predisposition to open city management processes to dialogue with the community, accounting for choices, behaviors and actions and responding in a timely and timely manner to the issues raised by stakeholders (Tisdall, 2017). This means that institutions must respond in a public, coherent and demonstrable way to the requests of citizens-consumers, verify the traceability of the administrative action, evaluate it from a civic point of view and guarantee the ability of the population to influence the methods of managing public services (Pereira & Roder Figueira, 2020). By placing the citizen at the center of administrative processes, it is possible to establish in advance the content of his right to participation, i.e. the right of each citizen-consumer to have clear, understandable and transparent information at every stage of his relationship with the provider of the service. Considering this, the right to participation to city management processes becomes fundamental in the public sector, in which, unlike what happens in the private sector in which, in the absence of information provided by an operator, one can contact another, the citizen has no alternatives (Tardivo et al., 2017).

Monitoring is expressed in the attitude of enforcing the rules, both in the sense of maintaining public action in the path traced by the laws, and in the sense of enforcing the norms of conduct to the operators of the Public Administration (Laguecir et al., 2020). Monitoring, therefore, refers to compliance with the rules and is intended both as a guarantee of the legitimacy of the action and as an adjustment of the action itself to the quality and appropriateness standards defined by the laws and regulations or by the commitments undertaken voluntarily by means of ethical guidelines or codes

of conduct (Alawattage & Azure, 2019). Therefore, in this respect, the SA could be defined as "the obligation to explain and justify one's behavior".

In a scenario characterized by high complexity and turbulence, as the public sector over the last years, LGs are called upon to adapt to the increasingly felt need of citizens to be kept informed of how their interests are regulated and how operate those who are responsible for carrying out their respective institutional tasks (Clune & O'Dwyer, 2020). It is necessary that the actions of the LGs are aimed at improving the effectiveness and efficiency of city management processes as well as satisfying their stakeholders and respecting the current regulatory framework, having among the main purposes that of being "accountable" for their interlocutors (Read & Atinc, 2017). This means that each body of which the Public Administration is composed has the duty to "inform all interested parties on how the responsibilities towards them have been fulfilled".

2.2 Social Accountability and Smart Cities

In recent years, the concept of "smart city" has influenced the current urban development and the future perspectives in this sector (Hollands, 2008). Smart city, in general, refers to a broad and all-embracing view of the urban landscape which is able to merge knowledge, sustainable approach and digital interface in only one theoretical and practical perspective (De Jong et al., 2015; Pellicano et al., 2018). As a broadly discusses by the consolidated literature, the strong and deep interconnection between city, governance, technologies, and citizens has opened up new possibilities for the well-being of the urban context. Smart technology, in fact, is considered a key lever for community well-being that should be associated with human and management skills to foster the emergence of sustainable growth (Barile et al., 2017; Ciasullo et al., 2020). In this regard, the emerging technologies such as Internet of things (or IoT) and Big Data, together with cognitive computing, advanced analytics and business intelligence, 5G networks, blockchain, anticipatory and context-aware computing and advanced distributed data warehouse platforms, allow to reach several advantages (Arasteh et al., 2016; Sicilia & Visvizi, 2019; Visvizi et al., 2018). As a valuable example, new technological platforms enable the improvement of the operations and services efficiency and real-time analysis of urban context, by providing raw material for envisioning and enacting more efficient, sustainable, competitive, productive, open and transparent cities (Kitchin, 2014; Peris-Ortiz et al., 2017). Accordingly, the goal is to integrate different infrastructures and services through the central role of the technology and strengthen the human network in order to improve the engagement between local governments and citizens.

Therefore, among the various dimensions of a smart city, the governance processes fulfil a central role. Technological platforms link and possibly integrate public, private, civil, and various stakeholders, at the same time ensuring transparency and removing the obstacles to innovative development posed by bureaucratization. Innovative approaches based on ICTs, if from one hand could ensure a more fluid use of the

services offered to citizens (eGovernment), on the other hand encourage their active participation in the administrative life of the city (e-Democracy) (Anthopoulos & Vakali, 2012). Also, the ICT-based platforms offer a wide range of information and data on the city in relation to different areas, such as mobility, infrastructure, energy, environment, territory, climate, etc., and citizens can participate directly in the development and co-production of high value-added services (Piro et al., 2014; Visvizi et al., 2017). The initiatives can regard the creation of the digital identity (unified digital document, unified registry office, digital home), which would allow citizens to quickly access various public areas such as mobility, health, and justice. Furthermore, the administration should be digitized through the publication of open data and the development of networked applications that can stimulate active participation. Transparency and speed can be guaranteed through the digitization of public procurement procedures (Neirotti et al., 2014).

In such a direction, the adoption of smart city initiatives can push towards the overcoming of the lack of involvement between citizens and local governments, emphasizing the need of a change orientation in favor of new forms of social accountability. Thereby, ICT infrastructures and innovative regulatory framework can encourage a renewal of public administrations' approaches in favor to more social accountable oriented practices in order to strengthen community-based initiatives and improve transparency and liability by guaranteeing access to information by holding stakeholders (Gaventa & McGee, 2010; Lytras & Visvizi, 2020; Visvizi & Lytras, 2020). Smart urban infrastructure connects citizens and communities in the development of smart governance in order to make shared decisions (Adhikari et al., 2018). Emerging technologies along with the participation, involvement, dialogue, and above all interaction between citizens and administrations help in planning and development, setting budgets, tracking expenditure, monitoring the performance of the implemented projects. In this way, community members and public administration are responsible to local agreements. Smart city thus becomes a co-designed city, result of a participatory process in which individuals rediscover the awareness that they can be co-authors of public policies (Lytras et al., 2020b). In particular, the transparent and dynamic network becomes a collective space where it is possible to implement the sense of social responsibility and to collaborate with local governments for encouraging ethical and concrete solutions. In this way, the citizens are capable to express their views, demanding their basic rights and complaining, where necessary, to those who are responsible. This may occur especially because most of citizens are willing to use smart city services that promote trusted news from local communities, access to learning and training resources plus services that sustain innovation and entrepreneurship at a global scale (Lytras et al., 2019). On the other hand, the willing to follow social accountable approaches can also strength the dialogue between ICT solutions and human users by improving the awareness and ability of citizens to use smart city services (Lytras & Visvizi, 2018).

However, despite the evidence of social accountable oriented behaviors in a context of urban smartness, little attention has been paid to the evaluation of the social accountability of the stakeholders involved in the smart cities initiatives. While certainly the role of smart governance processes and technological approaches have

been deeply investigated by the established literature, the contribute of ICT-enhanced services and applications of smart cities' initiatives to more socially accountable local governments is still continuing to be an open question.

3 Research Design

3.1 Approach

To answer the two RQs specified above—and, therefore, highlight how ICT-enhanced services and applications for smart cities allow the local governments to be more socially accountable (RQ_1) as well as to track the accountability of the stakeholders involved in the administration/management of smart cities (RQ_2)—, this work is carried out by following a qualitative survey, based on the collection, analysis, and interpretation of unstructured and non-numerical data (Hennink et al., 2020). Given its flexibility, this approach is widely employed in the social sciences and, more particularly, by accounting scholars since it allows observing and treating even complex phenomena (Silverman, 2016), investigating gnoseological paradigms ranging from positivism to post-positivism, from the critical theories to constructivism (Guba & Lincoln, 2005). Through qualitative research, the researcher aims to understand not only what the unit of analysis (e.g. individual, private company, public body, etc.) thinks, believes, or guesses but also the motivations underlying the relative opinion (Qu & Dumay, 2011).

The qualitative approach is followed through the administration of semi-structured interviews. The choice to use this data collection technique (instead of open or structured interviews) is justified by the consideration according to which, although presenting a fixed track, the further development of the interview varies according to the answers progressively provided. In fact, by administering semi-structured interviews, the researcher can deepen some topics that spontaneously emerge and that could be useful for understanding the phenomenon investigated (Cohen et al., 2002).

The basic scheme of the interviews administered has been defined by enucleating and adapting the key concepts related to the SA from the Public Management literature: participation; transparency; and monitoring. Based on the consideration emerged within the theoretical background, to identify the factors that LGs should consider to properly implement the SA and the differentiating elements in implementing the SA for smart cities, a semi-structured interview has been developed, consisting of open-ended questions, one for each attribute, as indicated below: (1) "What are the benefits that come or could derive from the implementation of SA?" (2) "Are there differences with respect to the approach that LGs employ to implement the SA in smart cities?" (3) "How do you assess the degree of stakeholders' participation in SA processes for smart cities?" (4) "How do you rate the level of transparency of the SA implementation processes in smart city projects?" (5) "How

do you evaluate the monitoring activities implemented in the SA implementation processes for smart cities?".

3.2 Data Collection and Analysis

Once the interview was structured, the next step was to collect data. To this end, the sampling procedure began with the sending of an email presenting the research project—context, objective, research questions—, and a request for membership to the heads of the administrative offices of all the municipalities of the province of Naples. A total of 412 emails were sent since, although the municipalities identified were less, the administrative offices of some of them have multiple email addresses. The managers of the offices of 119 municipalities responded to the first email, most of whom asked to receive the interview before expressing their willingness to join. A second email was sent containing a file with the interview to be administered and 88 municipalities agreed to take part in the project by responding to the interview. However, only 56 of them returned the updated file with their responses. Table 1 synthesizes data related to the respondents' socio-demographic profile. Overall, the data collection phase lasted about six months, from November 2019 to April 2020. Subsequently, the collected data were analyzed by the two authors, who, at first, to avoid a possible mutual influence, acted separately, interpreting the answers based on their knowledge and experience background. Subsequently, the comparison between the authors became necessary, as well as appropriate, to better target the conceptualization of the factors that LGs should consider to properly implement the SA and the differentiating elements in implementing the SA for smart cities. However, the

Table 1 Respondents' socio-demographic profile

Category	Feature	People	Percentage
Age	18–25	1	1.8
	26–35	5	8.9
	36–45	10	17.9
	46–65	28	50.0
	66+	12	21.4
Gender	Male	35	62.5
	Female	21	37.5
Education	Middle school graduation	0	0.0
	High school graduation	7	12.5
	three-year degree	16	28.6
	Master's degree	30	53.6
	Ph.D	2	3.6
	Other	1	1.8

comparison revealed uniformity in the interpretation of the information extrapolated from the interviews and this aspect highlight the coherence of the research design concerning the link between the objective pursued and the results obtained.

4 Results and Discussion

In this section, the authors present evidence to answer the research questions basing on the evaluation of the interviews carried out. Several highlights are emerged in relation to the smart city solutions and social accountable practices, as also highlighted in the Table 2.

About the first question—(1) "*What are the benefits that come or could derive from the implementation of SA?*"—among the important initiatives carried out by local governments in reference to social accountable practices, emerge the willingness to create constructive engagement between stakeholders, marked by a strong spirit of collaboration and not hostility (Ackerman, 2005). During the interviews, some governance mechanisms could be identified, such as, regulatory frameworks aimed at recognizing and sustaining good practices and on identifying problem areas for further improvement (Ahmad, 2008). According to the interviews, there is the widespread opinion that involving other types of stakeholders—such as the private sector, industry experts, public service providers, and the media—increases the impact of more social accountable initiatives.

Furthermore, the results highlight a homogeneity of thought of the respondents. In fact, all of them, as can be seen from the excerpts from the interviews shown below, declare that they have high confidence in the advantages that could arise in the coming years for those who deal with social accountable oriented practices, especially regarding the possibility to create partnership with all the stakeholders (O'Dwyer & Unerman, 2007).

> "*Social accountable approach sustains the stakeholder's meaningful participation in decision-making that affects their most immediate needs, especially in health, education and community infrastructure. While not always a requirement, engagement mechanisms such as the use of memorandum of understanding and similar instruments have proven useful in many settings*".
>
> "*Social accountability increases quality of government policy development and implementation processes, and thus becomes the principal method for solving governance issues that hinder improvement of quality of life of citizens.*"
>
> "*Social accountable initiatives aim to increase the transparency of governance in many areas thanks to ICT oriented approach, ranging from local service delivery to national processes of development policy formulation. In doing so, the government receives the propositions from their citizens and defines critical issues, explores their root causes and implements possible solutions. Governments and its contracted service providers must agree on immediate and clear next steps to address issues raised by citizens and other stakeholders. For instance, the predisposition of transparency portals such as budget websites can support the process of budget related to social accountable works.*"

Table 2 Results overview

Social accountable practices in smart cities context	Findings
Benefits	• Definition of regulatory frameworks; • Constructive engagement between stakeholders; • Stakeholders' participation in decision-making process (e.g. use of memorandum of understanding); • Improvement of quality of government policy development and implementation processes; • Transparency of governance thanks to ICT oriented approach; • Socio-cultural openness
Characteristics	• Proactive use of the city's ICT infrastructure; • Open and inclusive public administrations; • Implementation of personalized, user-friendly, end-to-end digital public services
Assessment of the degree of stakeholders' participation	• Social platform participation; • Social app engagement; • Living labs involvement
Rating the level of transparency	• Information sharing in the government channels; • Government operations accessible to people; • Implementation of advanced ICTs; • Predisposition of transparency portals such as budget websites; • Open data approach
Monitoring activities	• Implementation of smart technological tools and emerging methodologies based on big data approach; • Application on monitoring of expenditure (e.g. regarding medicines); • Application on monitoring of public services delivery from online discussion

Source Authors' elaboration from data analysis

However, younger respondents, which belong to the age range 26–35, highlight the importance of the socio-cultural openness in order to implement social accountable oriented approach (Gilbert & Rasche, 2007; Skelton, 2010).

"*Social accountable practices are largely determined by existing contextual and cultural conditions. To a large extent, SA- practices must respond to and operate within the larger context and framework of a sector, nation, or region. The appropriateness of the social accountable approach—including tools, techniques and other mechanisms—are determined against political, socio-cultural, legal and institutional factors and depends on eco-political realities*".

"*To ignore context and culture is to risk alienating local stakeholders which could be unfriendly towards social accountable oriented practices*".

Even with respect to the second question—(2) "*Are there differences with respect to the approach that LGs employ to implement the SA in smart cities?*"—the respondents' opinions appear to converge:

> "*In the smart city perspective, the participation is a key aspect for fostering a more social accountable vision. However, respect to the traditional approach, smart city vision can proactively use the city's ICT infrastructure for facilitating stakeholder's involvement in the democratic process and for cocreating the smart city projects*".

> "*The perspective of smart city is very broad and include the social accountable oriented practices. Especially, in our project vision, public administrations and public institutions should be open, efficient and inclusive, providing borderless, personalized, user-friendly, end-to-end digital public services to all citizens […] Innovative approaches should be considered as pillar to design and deliver better services in line with the needs and demand of citizens and businesses*".

In this regard, the interviews analyzed referring to question 1 and 2 present suggestions to address RQ1. Starting from the concepts developed by the consolidated literature of the social accountability, the ICT-enhanced services and applications for smart cities allow the local governments to be more socially accountable by exploiting the opportunity offered by the new digital environment to facilitate their interactions with stakeholders and with each other in order to make more socially responsible the governance process (Axelsson et al., 2010). Compared to traditional public administration initiatives, the growth of smart cities initiatives is assisting the rise of government employment of ITCs to enhance political participation, enforce public schemes or supply public sphere services. In such a direction, local governments involved in the implementation of smart city projects are consistently spending on ICT in order to help with the challenges in maintaining the democratic system of checks and balances as well as the division of powers in a highly interconnected world (Anthopoulos, 2017; Visvizi & Lytras, 2020).

Unlike the first and the second questions, the answers provided to the third question—(3) "*How do you assess the degree of stakeholders' participation in SA processes for smart cities?*"—show a lack of homogeneity of thought.

In general, from the majority of people surveyed emerge the strategical aspect of the social platform for improving the engagement in relation to social accountable oriented practices.

> "*Personally, I found useful to assess the degree of stakeholders' engagement thanks to social platforms. For instance, in our project, we engage citizens in the creation and implementation of policies aimed at promoting sustainable local mobility thanks a social app which shows the citizens which was contributed to the mobility questions. So, thanks to the smart social interface we consider the perspective of a wide level of stakeholders*".

This evidence, along to other works listed in the reference literature, outlines a strategy incorporating both social media and social platform approaches in order to increase the degree of social participation (Bakardjieva et al., 2012).

On the other hand, by analyzing the answers provided by the interviewed with higher level of education it emerges that "*I consider the Living Labs extremely suitable for evaluate the level of citizens engagement. Living Labs is a concept used as*

part of the stakeholder engagement process in our project in order to test in a real life setting new products or services. The main goal of our initiatives is to coordinate end-user and stakeholder involvement in the Living Lab activities as a process of engaging stakeholders in a systematic way".

> "*Living lab consist of open innovation ecosystems based on systematic user co-creation approach, integrating research and innovation processes in real life communities and settings. In this way, we consider the users engagement by evaluating the interest of citizens, research organizations, companies, cities and regions in joint value co-creation".*

The answers given to the fourth question—(4) "*How do you rate the level of transparency of the SA implementation processes in smart city project*"—show a commonality of thought among the members of the selected sample, as can be seen from the excerpts of interviews shown below.

> "*One of the main aspects to make a city smarter is the use of data and information in the government channels in in order to make government operations accessible to people. In this way, the emerging technologies can help the online transparency within smart cities and among smart cities throughout the world and to reinforce social accountable oriented practices*".
>
> "*Social accountability increases transparency and quality of government policy development and implementation processes, and thus becomes the principal method for solving governance issues that hinder improvement of quality of life of citizens. So, social accountable initiatives aim to increase the transparency of governance in many areas thanks to advanced ICTs, especially considered in the smart city model, ranging from local service delivery to national processes of development policy formulation. In doing so, the government receives the propositions from their citizens and defines critical issues, explores their root causes and implements possible solutions*".
>
> "*Governments must agree on immediate and clear next steps to address issues raised by citizens and other stakeholders. As a specifical example, the predisposition of transparency portals such as budget websites and an open data approach—typical of smart city vision—can support the social accountability.*"

Several elements emerge from the answers to the fifth question—(5) "*How do you evaluate the monitoring activities implemented in the SA implementation processes for smart cities?*".

In particular:

> "*The monitoring variable is a key aspect of the social accountable oriented practices and refers to set of smart technological tools and emerging methodologies typically agreed on by all involved which can deal with perception or satisfaction data (e.g., citizen feedback on clinical services) or to the more technical aspects of service delivery (e.g., monitoring expenditure on medicines). For instance, referring to the monitoring of public services and good, LGs in the context of smart city can benefit from online discussion*".
>
> "*By analyzing the online discussion and forum it is possible to create a classification of the problem general perceived by the community*".

Therefore, the interviews analyzed referring to Question 3,4, and 5 present evidence to answer RQ2. Accordingly, ICT-enhanced services and applications for smart cities allow to track the accountability of the stakeholders involved in the

administration/management of smart cities thanks to new forms of dynamic interactions between local governments and citizens which are increasing the transparency and the monitoring of the information flow (Matheus et al., 2018). Besides this, it is necessary to invest in the stakeholders' involvement through the implementation of strategies oriented towards Open Data Governance (Troisi, 2016), capable of highlighting the potential of the reuse of data owned by the public administration for enabling new forms of participation in which citizens in a proactive way participate in the governance process.

5 Implications and Final Remarks

The modern technological environment appears able to deeply change the world in which we all live every day, with reference to the urban landscape which has become global, digital, and interconnected. The broad and all-embracing concept of smart city encourages a rethinking of local governments approaches in favor of more socially accountable practices which can, in a dynamic and proactive way, strength the dialogue and a relationship with all its stakeholders by promoting a sustainable development and a social wellbeing (Visvizi & Lytras, 2020).

Collaboration, participation, and above all interaction between local governments and citizens seem to be new keywords on which to base a paradigmatic shift for urban governance. In this way, smart city becomes a co-designed city, result of a participatory process in which individuals rediscover the awareness that they can be co-authors of public policies. The transparent network, composed by the consistent information flow and advanced social platforms development, becomes a collective space where it is possible to implement responsible behaviors and to collaborate with public administrations for encouraging ethical and concrete solutions.

From a managerial point of view, the results of the analysis suggest that it is necessary to invest in the stakeholders' involvement through the implementation of strategies oriented towards Open Data Governance (Troisi, 2016), capable of highlighting the actual benefits deriving from the synergic collaboration among local governments and stakeholders. In fact, the transparency, thanks to the reuse of data owned by the public administration (open data), enables new forms of participation in which citizens in an increasingly horizontal and proactive way became essential part of the governance process. Thus, smart city policies should set an expectation of public disclosure of the types of data being collected, as well as methods of data storage and transfer. This can be facilitated through the creation of a data inventory, to record basic information about data collected from ICT enhanced services (Kourtit et al., 2017; Visvizi et al., 2018). In such a direction, appears evident the necessity to define action framework able to define the multifaceted aspects which should be taken into account in the implementation of an efficient and accountable smart cities initiatives. The regulatory framework should be publicly available, easily accessible, and subject to public comment (Castelnovo et al., 2016; Lytras et al., 2020a).

On the other hand, from a theoretical point of view, the strong and deep connection between citizens and emerging technologies is highlighted. In fact, only thanks to the human propension to use smart city services is possible to reinforce social accountable practices at a global scale (Lytras et al., 2019). On the other hand, the possibility of implementing socially responsible practices can also enhance the dialogue between ICT solutions and human users by encouraging citizens to learn digital services in favor of greater involvement in governance processes to use smart city services (Lytras & Visvizi, 2018). Along these lines, smart cities policies should push public officials to clear transparency and public accountability standards around emerging technologies implementation. To this end, there should be a public discussion regarding the implementation of new ICT services even before the procurement process begins. In fact, it is necessary that all the innovative and smart solutions adopted are accepted by all the stakeholders involved in the process (Sepasgozar et al., 2019).

By concluding, urban context which are striving to increase data collection and real-time analysis for improved social wellbeing recognize that data transparency is integral to an efficient and accountable perspective of smart city. As a result, smart cities should open data and manage information as a public good. Cities that prioritize open data thanks to open data portals and open data infrastructure allow for more creative uses of data and provide new opportunities for public engagement, citizen empowerment, and social accountable oriented practices. To these ends, the adoption of smart cities initiatives will require prioritizing digital inclusion and tackling the digital divide (Lytras et al., 2020a, b; Neves et al., 2020).

References

Ackerman, J. M. (2005). *Social accountability in the public sector: A conceptual discussion* (No. 35733, p. 1). The World Bank.

Adhikari, B. K., Zuo, W. L., Maharjan, R., & Yadav, R. K. (2018). Use of big data analytics in WASH sector. In *2018 second international conference on intelligent computing and control systems (ICICCS)* (pp. 1185–1190). IEEE.

Ahmad, R. (2008). Governance, social accountability and the civil society. *JOAAG, 3*(1), 10–21.

Alawattage, C., & Azure, J. D. C. (2019). Behind the World Bank's ringing declarations of "social accountability": Ghana's public financial management reform. *Critical perspectives on accounting*, pp.1–22.

Anthopoulos, L. G. (2017). *Understanding smart cities: A tool for smart government or an industrial trick?* (Vol. 22). Springer International Publishing.

Anthopoulos, L. G., & Vakali, A. (2012). Urban planning and smart cities: Interrelations and reciprocities. In *The future internet assembly* (pp. 178–189). Springer.

Arasteh, H., Hosseinnezhad, V., Loia, V., Tommasetti, A., Troisi, O., Shafie-khah, M., & Siano, P. (2016). Iot-based smart cities: a survey. In *2016 IEEE 16th international conference on environment and electrical engineering (EEEIC)* (pp. 1–6). IEEE.

Axelsson, K., Melin, U., & Lindgren, I. (2010). Exploring the importance of citizen participation and involvement in e-government projects. *Transforming Government: People, Process and Policy., 4*(4), 299–321.

Bakardjieva, M., Svensson, J., & Skoric, M. (2012). Digital citizenship and activism: Questions of power and participation online. *4*(1), 1–5

Barile, S., Ciasullo, M. V., Troisi, O., & Sarno, D. (2017). The role of technology and institutions in tourism service ecosystems. *The TQM Journal, 29*(6), 811–833.

Boyce, G., & Davids, C. (2009). Conflict of interest in policing and the public sector: Ethics, integrity and social accountability. *Public Management Review, 11*(5), 601–640.

Brinkerhoff, D. W., & Wetterberg, A. (2016). Gauging the effects of social accountability on services, governance, and citizen empowerment. *Public Administration Review, 76*(2), 274–286.

Cassano, R. (2017). Transparency and social accountability in school management. *Symphonya. Emerging Issues in Management, 2*, 19–30.

Castelnovo, W., Misuraca, G., & Savoldelli, A. (2016). Smart cities governance: The need for a holistic approach to assessing urban participatory policy making. *Social Science Computer Review, 34*(6), 724–739.

Ciasullo, M. V., Palumbo, R., & Troisi, O. (2017). Reading public service co-production through the lenses of requisite variety. *International Journal of Business and Management, 12*(2), 1–13.

Ciasullo, M. V., Troisi, O., Grimaldi, M., & Leone, D. (2020). Multi-level governance for sustainable innovation in smart communities: an ecosystems approach. *International Entrepreneurship and Management Journal*, 1–29.

Clune, C., & O'Dwyer, B. (2020). Organizing dissonance through institutional work: The embedding of social and environmental accountability in an investment field. *Accounting, Organizations and Society*, *85*, 101130.

Cohen, J., Krishnamoorthy, G., & Wright, A. M. (2002). Corporate governance and the audit process. *Contemporary Accounting Research, 19*(4), 573–594.

De Jong, M., Joss, S., Schraven, D., Zhan, C., & Weijnen, M. (2015). Sustainable–smart–resilient–low carbon–eco–knowledge cities; making sense of a multitude of concepts promoting sustainable urbanization. *Journal of Cleaner Production, 109*, 25–38.

Dumay, J., & De Villiers, C. (2019). Qualitative accounting research: Special issue introduction. *Accounting & Finance, 59*(3), 1449–1458.

Dunleavy, P., & Hood, C. (1994). From old public administration to new public management. *Public Money & Management, 14*(3), 9–16.

Gaventa, J., & McGee, R. (2013). The impact of transparency and accountability initiatives. *Development Policy Review, 31*, s3–s28.

Gilbert, D. U., & Rasche, A. (2007). Discourse ethics and social accountability: The ethics of SA 8000. *Business Ethics Quarterly*, 187–216.

Gray, R., Owen, D., & Maunders, K. (1988). Corporate social reporting: Emerging trends in accountability and the social contract. *Accounting, Auditing & Accountability Journal, 1*(1), 6–20.

Guba, E. G., & Lincoln, Y. S. (2005). Paradigmatic controversies, contradictions, and emerging confluences. *The landscape of qualitative research*, 255–286.

Hennink, M., Hutter, I., & Bailey, A. (2020). *Qualitative research methods.* SAGE Publications Limited.

Hollands, R. G. (2008). Will the real smart city please stand up? Intelligent, progressive or entrepreneurial? *City, 12*(3), 303–320.

Joshi, A., & Houtzager, P. P. (2012). Widgets or watchdogs? Conceptual explorations in social accountability. *Public Management Review, 14*(2), 145–162.

Kitchin, R. (2014). Big Data, new epistemologies and paradigm shifts. *Big data & society*, *1*(1), 2053951714528481.

Kourtit, K., Nijkamp, P., & Steenbruggen, J. (2017). The significance of digital data systems for smart city policy. *Socio-Economic Planning Sciences, 58*, 13–21.

Laguecir, A., Kern, A., & Kharoubi, C. (2020). Management accounting systems in institutional complexity: Hysteresis and boundaries of practices in social housing. *Management Accounting Research, 49*(1), 1–14.

Lytras, M. D., & Visvizi, A. (2018). Who uses smart city services and what to make of it: Toward interdisciplinary smart cities research. *Sustainability, 10*(6), 1998–2014.
Lytras, M. D., Visvizi, A., & Sarirete, A. (2019). Clustering smart city services: Perceptions, expectations, responses. *Sustainability, 11*(6), 1669–1688.
Lytras, M., Visvizi, A., Zhang, X., & Aljohani, N. R. (2020a). Cognitive computing. *Big Data Analytics and Data Driven Industrial Marketing, 90*(1), 636–666.
Lytras, M. D., & Visvizi, A. (2020). Information management as a dual-purpose process in the smart city: Collecting, managing and utilizing information.
Lytras, M. D., Visvizi, A., Chopdar, P. K., Sarirete, A., & Alhalabi, W. (2020b). Information Management in Smart Cities: Turning end users' views into multi-item scale development, validation, and policy-making recommendations. *International Journal of Information Management*, 1–10.
Malena, C., Forster, R., & Singh, J. (2004). *Social accountability: An introduction to the concept and emerging practice* (No. 31042, p. 1). The World Bank.
Matheus, R., Janssen, M., & Maheshwari, D. (2018). Data science empowering the public: Data-driven dashboards for transparent and accountable decision-making in smart cities. *Government Information Quarterly, 37*(1), 1–9.
Mele, R., Calabrese, M., & Troisi, O. (2012). Communication at local autorities: Amid institutional communication and political communication. *Sinergie Italian Journal of Management, 1*(1), 89–105.
Neirotti, P., De Marco, A., Cagliano, A. C., Mangano, G., & Scorrano, F. (2014). Current trends in smart city initiatives: Some stylised facts. *Cities, 38*, 25–36.
Neves, F. T., de Castro Neto, M., & Aparicio, M. (2020). The impacts of open data initiatives on smart cities: A framework for evaluation and monitoring. *Cities, 106*(1), 1–15.
O'Sullivan, N., & O'Dwyer, B. (2015). The structuration of issue-based fields: Social accountability, social movements and the Equator Principles issue-based field. *Accounting, Organizations and Society, 43*, 33–55.
O'Dwyer, B., & Unerman, J. (2007). From functional to social accountability: Transforming the accountability relationship between funders and non-governmental development organisations. *Accounting, Auditing & Accountability Journal, 20*(3), 446–471.
Parker, L. D. (1991). External social accountability: Adventures in a maleficent world. *Advances in Public Interest Accounting, 4*, 23–34.
Pellicano, M., Calabrese, M., Loia, F., & Maione, G. (2018). Value co-creation practices in smart city ecosystem. *Journal of Service Science and Management, 12*(1), 34–57.
Pereira, D., & Roder Figueira, A. (2020). Effects of citizen participation in the social accountability of budget amendments. *The Journal of Legislative Studies*, 1–25.
Peris-Ortiz, M., Bennett, D. R., & Yábar, D. P. B. (2017). Sustainable smart cities. *Innovation, technology, and knowledge management*.
Piro, G., Cianci, I., Grieco, L. A., Boggia, G., & Camarda, P. (2014). Information centric services in smart cities. *Journal of Systems and Software, 88*, 169–188.
Polese, F., Troisi, O., Carrubbo, L., & Grimaldi, M. (2018). An integrated framework toward public system governance: Insights from viable systems approach. In *Cross-sectoral relations in the delivery of public services*. Emerald Publishing Limited.
Qu, S. Q., & Dumay, J. (2011). The qualitative research interview. *Qualitative Research in Accounting & Management, 8*(3), 238–264.
Read, L., & Atinc, T. M. (2017). Information for accountability: Transparency and citizen engagement for improved service delivery in education systems. 1–52.
Schmidt, V., & Wood, M. (2019). Conceptualizing throughput legitimacy: Procedural mechanisms of accountability, transparency, inclusiveness and openness in EU governance. *Public Administration, 97*(4), 727–740.
Sepasgozar, S. M., Hawken, S., Sargolzaei, S., & Foroozanfa, M. (2019). Implementing citizen centric technology in developing smart cities: A model for predicting the acceptance of urban technologies. *Technological Forecasting and Social Change, 142*, 105–116.

Sicilia, M. Á., & Visvizi, A. (2019). Blockchain and OECD data repositories: opportunities and policymaking implications. *Library hi tech.*

Silverman, D. (2016). Introducing qualitative research. *Qualitative research*, 3–14.

Skelton, T. (2010). Taking young people as political actors seriously: Opening the borders of political geography. *Area, 42*(2), 145–151.

Tardivo, G., Bresciani, S., & Viassone, M. (2017). A descriptive framework for an excellent social accountability. *International Journal of Managerial and Financial Accounting, 9*(2), 166–181.

Tisdall, E. K. M. (2017). Conceptualising children and young people's participation: Examining vulnerability, social accountability and co-production. *The International Journal of Human Rights, 21*(1), 59–75.

Troisi, O. (2016). *Governance e co-creazione di valore nella PA: Una rilettura in ottica service-dominant logic* (Vol. 60). G Giappichelli Editore.

Troisi, O., Maione, G., Grimaldi, M., & Loia, F. (2020). Growth hacking: Insights on data-driven decision-making from three firms. *Industrial Marketing Management, 90*, 538–557.

Visvizi, A., & Lytras, M. D. (2020). Sustainable smart cities and smart villages research: Rethinking security. *Safety, Well-Being, and Happiness, 12*(1), 1–4.

Visvizi, A., Mazzucelli, C., & Lytras, M. (2017). Irregular migratory flows. *Journal of Science and Technology Policy Management, 8*(2), 227–242.

Visvizi, A., Lytras, M. D., Damiani, E., & Mathkour, H. (2018). Policy making for smart cities: Innovation and social inclusive economic growth for sustainability. *Journal of Science and Technology Policy Management, 9*(2), 126–133.

Willems, J., Van den Bergh, J., & Viaene, S. (2017). Smart city projects and citizen participation: The case of London. In *Public sector management in a globalized world* (pp. 249–266). Springer Gabler, Wiesbaden.

Francesca Loia, Ph.D., Research Fellow, Department of Economics, Management and Institutions, University of Naples 'Federico II', Naples, Italy. Her research interests include Information and Communication Technology (ICT), decision making, service science (SS), and viable system approach (VSA).

Gennaro Maione Ph.D., Researcher, Department of Economics and Statistics, University of Salerno, Fisciano, Italy. His research interests include public sector accountability, digitalization, and environmental accounting.

How to Improve Social Participation of Senior Citizens Thorough ICTs: A Techno-Demographic Challenge for an Effective Smart City

Stefano Poli, Mauro Palumbo, and Stefania Operto

Abstract Contemporary cities, particularly those in Western societies, are interested in a diffused demographic ageing, and a growing share of older residents is facing the challenges of rapid social, cultural, and technological development. Such processes have a double-sided effect; on the one hand, it represents a potential widening of the digital and cultural gap, utterly reproducing marginalisation and social exclusion for older generations, especially the frailest and secluded elderly profiles, but on the other hand, it provides an opportunity for the new generation of older adults, which is characterised by a higher demand of social participation and self-expression. In this sense, applying technology to the lives of older people becomes an issue for contemporary smart cities that must find and provide potential solutions for assistive technology (e.g., through robotics and telecare services in the area of risk management and assessment), while also recognising the new needs regarding social inclusion and participation of the arising smarter and resourceful baby boomer generation who are more demanding in terms of expression of personal identities and interested in new opportunities for active citizenship and social participation, all of which can be supported by new technologies. From such a perspective, the chapter aims to describe the main issues of how contemporary urban contexts, which are often characterised by difficulties of the ageing in place, can employ new technologies to improve the social participation and inclusion of older residents. It also proposes possible recommendations for how to apply new technological solutions among older users.

Keywords Ageing · Inequalities · Technology · Social inclusion · Participation · Smart cities

S. Poli (✉) · M. Palumbo · S. Operto
University of Genova, Genoa, Italy
e-mail: stefano.poli@unige.it

M. Palumbo
e-mail: mauro.palumbo@unige.it

S. Operto
e-mail: stefania.operto@unige.it

A. Visvizi and O. Troisi (eds.), *Managing Smart Cities*,
https://doi.org/10.1007/978-3-030-93585-6_11

1 Living Older in Contemporary Urban Context: Ageing in Place, Technology, and Heterogeneity Among Older People

Contemporary urbanisation is characterised by several dimensions, in terms of *scale* (considering, for instance, the rise and demographic development of global cities due to globalisation) and *speed of urbanisation* (particularly in developing countries), but especially in terms of *complexity* (for the multifaceted functionality of urban areas as centres of production and consumption, as well as nodes within transnational networks for people and goods) and of *mobility* of population (both due to migration of younger adults from rural areas and declining industrial centres, as well as increasing inequalities deriving from the gentrification of central residential areas that attracts richer and younger high-skilled newcomers and pushes away older and poorer inhabitants).

According to Phillipson (2013), such issues interest older residents of contemporary cities in several ways, but especially because the combination of the aforementioned dimensions reproduce two opposing patterns. On the one hand, they produce the hypermobility of ideas and people, leading major post-industrial cities to become professionalised and polarised along socioeconomic and class lines defined by the interests of upper and middle-class white-collar inner-city gentry mostly composed by younger professionals and dominant productive urban élites (Butler et al., 2008). On the other hand, they produce the ageing in place process, a static form of marginalisation and social exclusion, reproducing what Beck (1998) calls the "architecture of apartheid" in modern cities, which is defined by the physical and symbolic yet extremely impassable barriers separating social and economic life groups such as those affected by disabilities, older age, loneliness, and deprivation (Wiles et al., 2011).

Technology and technological access play a key role in these patterns in both symbolic and concrete ways. Indeed, the impact of technology can reproduce and enlarge a digital divide, widening the gap between the urban élites and the excluded groups. It can also become a tool, however, for giving solutions to the needs of the oldest, frailest, and poorer profiles of elderly populations. Furthermore, it can become an instrument for inclusion and social participation especially for the most resourceful of older people, which, operating as a cultural avant-garde, can also extend benefits to the most marginalised and socially vulnerable profiles.

In this sense, applying technology to the lives of older people from a productive and economic perspective is mostly conceived today according to the typical stereotype of the "deficit model," essentially referred to as the medicalisation of ageing itself (Fulop et al., 2019). According to such a model, technology is related essentially to the needs of the frailest and less autonomous senior citizens; in terms of assistive technology, for instance, this would apply to the use of robotics and the application of telecare services in the area of risk management and assessment. Far from criticising the usefulness of technology in such dimensions (and considering its positive impact on potentially reducing the rising burden of healthcare), the use of new technologies,

particularly of ICTs, among older people must also be related to other opportunities: above all, those of social inclusion and active participation.

Alas, in such a perspective, the role of older people themselves must also be reconsidered as users and consumers of technology, who hold different attitudes and approaches to technologies due to cultural and socioeconomic differences enlarged by the rising heterogeneity of behaviours within and between different generations of mature citizens. Indeed, older adults as a group are not monolithic with respect to technological usage, particularly regarding internet and its opportunities (McDonough, 2016).

In such a perspective, we have to consider that technology, as a factor of social change, impacts older people differently. Focusing on relevant factors concerning the implications of technology on older populations, McCreadie (2013) refers to stratification, social capital, organisational behaviour, and people's sense of personal and social identity.

Stratification refers to aspects of systematic social division defined by class and status factors, ranging, for instance, from income, property, education, occupation, and social background. Such elements, in turn, intersect with hybridised classless inequality factors like age istelf, but also with gender, ethnicity, and overall access to rights (Pakulsky, 2007). Still, technology access remains affected by income in contemporary society, where a larger part of older residents risk exclusion (Jones et al., 2008).

Social capital refers to the ability of individuals to secure benefits from their wider social belonging in terms of family, neighbourhood, friendship, and network, as well as concrete and symbolic forms of membership, which are helpful in defining their lifestyle and overall quality of life. In this sense, access to technology can represent an invaluable tool in terms of promoting or reducing individual social capital of older people.

Organisations represent mostly a structural factor to consider how public and private services interact with older users. From banks to healthcare services, supermarkets, and mobile companies, all of these entitites interact with older people, and the speeed of automatisation and use of technology in such interactions affects older users and consumers differently.

Lastly, the sense of personal and social identity, besides referring implicitly to an individual dimension, can be related to a collective persperctive if we consider the heterogeneity of older people according to a generational approach. Such a perspective substantially intersects and partially syntethises most of the previously mentioned issues in terms of stratification, social capital, and reaction to organisational change. Indeed, even if far from a strict and rigid typology and taking into considerable account the expectable individual differences, older people can be classified according to three main generations, each with a different passive or active perspective regarding technology. Referring to an almost classic typology according to Howe and Strauss (1991), the oldest old profiles can be understood as pertaining to the so-called Greatest Generation, born in the first decades of the last century and demographically mostly residual. Such generation has generally, even if not necessarily, a passive approach to technology that prevalenty refers to technology

assisted healthcare due to the frequency of frail conditions among such age cohorts. A second but much wider social group can be represented by the so-called Silent Generation, born before the end of the Second World War. Here we can encouter a combination of factors, depending both on often lesser health and socioeconomic conditions, but also on differences in terms of cultural approach. Indeed, this generation, having spent most of their childhood between the years of the Great Depression and the end of the Second World War and their early adulthood in the period of the material and social rebuild after the war, is typically defined by a more traditional and conservative approach, aimed to match the instutionalised value system of the industrial society. In this sense, this generation implicitly suffered as a result of the social change and innovation of the globalised society and is consequenly severely affected by a wider and diffused digital gap, in addition to a structurally lower access to technology itself. In constrast, the Baby boomer generation, particularly the oldest individuals in this age group, born in the period between 1946 and 1954, currently represents the new frontier of the ageing population. Now in their late occupational or early retirement phase, they grew up from youth to adulthood during the diffused collectivism promoting the Civil Rights Movements in the late sixties and the early individualism and consumerism that diffused across Western society during the later phase of the Cold War. They spent a large part of their occupational life in the affluent stability of the early postindustrial society and they have being adequately involved in the technological changes of the last three decades that have interested both the productive system and society as a whole. Often culturally characterised by a free-spirited, experimental individualism and by a strong sense of self-expression, they often look to technology as a tool and an opportunity for reproducing their sense of exploration and self-discovery and, especially, for their social participation due to their strong sense of social cause orientation (Green, 2006; Leach et al., 2008).

In the following pages, we will examine the aforementioned issues with special regards to the use of technology as an inclusive tool for social participation and to possible issues and recommendations for public policies aimed to effectively realise technologically smart cities for older residents.

2 Ageing, Technology, and Social Participation

Although political participation is an important form of social inclusion, it is sharply decreasing in Western countries. Higher rates of electoral participation among older population have been reported, but the crisis of representative democracy has deepened in the last decades (Tormey, 2015). At the same time, increasingly articulated forms of democratic innovations are emerging, trying to compensate the fall of legitimacy of public institutions and the parties that governs institutions by means of the electoral competition. And there is no evidence that older people are adequately present in these alternative/integrative forms of political participation.

The forms of bottom-up participative democracy have multiplied in recent years, although the question of how much participative processes can attain the deliberative

level (House & Howe, 2000) remains unsolved solved, as it depends on the role of the participative activities in the formal decisional processes. This role changes according to the interplay between social movements and institutions, as well as the effectiveness of the implemented participatory processes (Richards & Gastil, 2015). A good example in this vein is Tuscany Region, a pioneer in this field with two laws that promotes stakeholders' participation in the planning and evaluation of social policies (n. 69/2007 and n. 46/2013).

Here we briefly recall only two important aspects. The first relates to participation in public decision-making, and the second is participation in the design of public policies and interventions. The distinction is important because planning is the responsibility of public institutions, and the less they are legitimised by the representative democracy (elections and deliberations in institutional bodies), the more they must build or implement their legitimacy as much as possible with the consent of citizens. So the diffusion of "top-down" forms of participatory democracy is often a way to gain public legitimacy for decision-making in the public sector. The operational design of public interventions is equally important because it is in the phase of the design that public policies becomes concrete, and, in this case, the risk of policies adopted is even more marked regardless of the opinions and expectations of the recipients. In fact, a large part of public services assumes that the user activates himself for the enjoyment of their benefits; if this does not happen, because he is not involved in the design, suboptimal choices, when not blatantly incorrect, are taken.

Of course, such problems affect the entire population, albeit in different ways; the elderly may have greater solicitations and better reasons to participate, but fewer opportunities and chances to do so. Hence, the challenge is to use technology to reduce, rather than to enlarge, the democratic and technological gap.

In a previous paper (De Cindio et al., 2014), we pointed out that ICT offers many opportunities for the participation of citizens in decision-making processes, and are necessary for both the integration between online and off-line modalities and the adoption of theoretical and methodological frameworks allowing effective participation.

According to the methodological framework, three main aspects regarding participation must be considered. The first one is the level and type of participation. Referring to the Spectrum of Policy Participation proposed by the International Association for Public Participation (Spectrum_8.5 × 11_Print (ymaws.com)), there are five levels of participation corresponding to five goals and promises to the public—information, consultation, involvement, collaboration, and empowerment—with different types or intensity of the direction of information flow (one-way or two-ways), the relationship between citizens and institutions, and the degree of integration of the results of participation within the formal process of public decision making.[1] Different

[1] The promises to the public grow according to the different levels of participation: from "we will keep you informed" (inform level) to "we will seek your feedback on drafts and proposals (consult level), to "we will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed" (involve level), to "we will work together with you to formulate solutions and incorporate your advice and recommendations into the decisions," and finally to "We will implement what you decide" (empower level). *Source* Spectrum_8.5 × 11_Print (ymaws.com).

kinds and occasions of participation can suggest one or more of these five levels; in other words, by distinguishing between participation "as a mean" and participation "as an end," we can avoid populistic temptations and use the kind of participation that truly fits the purpose. Although it is sometimes possible and also desirable to consider each form of participation as a step toward the last (empowerment), in general cases, if our main aim is to ameliorate public policies by means of participation, we must define what kind of participation can maximise the effectiveness of the policy itself. Therefore, it is not true that the more intense the participation, the better the decision-making process will be. Rather, it is necessary to choose the "right" form of participation, a choice that is also connected with the second dimension, the shape of the policies, or the extension of the area covered by the program. Participating in a local or specific plan can be made using some kind of direct involvement of citizens, unlike participation in bigger plans; this means that the adopted methodology and instruments must be adequate to the extension of the policy design and that there is no methodology that is suitable for all cases (Congiu et al., 2012). There is no room in this chapter for a detailed discussion of the ways to optimise online and off-line participation or the pros and cons of the most used tools for democratic participation; however, the different degrees of power among citizens who will be involved in deliberative processes must be considered. If a significant inequality exists between different groups, greater precautions must be taken. For example, it can be useful to provide separate opportunities for confrontation to avoid marginalising less educated or less informed people at the beginning of participatory processes. Within undifferentiated decision-making arenas, people with more power or social prestige prevail and deliberative democracy ends up reproducing the inequalities that have contributed to making representative democracy inadequate (Karpowitz et al., 2009).

The third dimension is the kind of participant: citizens, informal organisations, and formal organisations. Often the participation of stakeholders "stands for" that of the citizens and in fact helps to exclude them. The crisis of representation is not only affecting political institutions, but rather all forms of representative associations; therefore, the direct participation of citizens does not appear to be completely fungible from that of their organizations. So even a proper dosage of different participation modes for different kinds of subjects becomes necessary (see Palumbo, 2009). Research in this field shows that citizen and stakeholder roles can be separated or combined within a participative process, with different effects on the scope and effectiveness of participation (Kahane et al., 2013).

This means that the problem of participation of older people must be addressed inside the greater one of citizen participation as a whole, while also considering the addition of the aforementioned difficulties specific to old people.

As mentioned previously, the main form of participation in complex society is the co-construction of social policies and public interventions. The decline of the synoptic rationality paradigm in public decision-making (Lindblom & Braybrooke, 1963) has made it clear that public interventions are not programmed in a top-down form, but rather in ways often inspired by the garbage can model (March & Olsen, 1976), which assigns great importance to actors who participate at a given time to the

concrete decision-making process. A few decades later, the convergence of diverse processes, such as the ICT diffusion, the increasing role of the web, globalisation, the diffusion of new forms of relationships between industries, research, and institution, paved the way to the phenomenon of "co-production" or "co-creation" of goods and services. As noted in a previous contribution (Cossetta & Palumbo, 2014), open innovation and social innovation have defined new frontiers in the participation of citizens in the creation of new goods that have become fundamentally importance in the field of public services. The official definition of open innovation, a concept based on the observed fact that useful knowledge today is widely distributed, is that "Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. [This paradigm] assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology" (Chesbrough, 2006, p. 1). Closely linked to this new paradigm is social innovation, or what is known as the citizen's side of the coin: "A novel solution to a social problem that is more effective, efficient, sustainable, or just than existing solutions and for which the value created accrues primarily to society as a whole rather than private individuals" (Phills et al., 2008, p. 39). According to other influent authors, "We define social innovations as new ideas (products, services and models) that simultaneously meet social needs and create new relationships or collaborations. In other words, they are innovations that are both good for society and enhance society's capacity to act" (Murray et al., 2010, p. 7).

These definitions reveal the challenges for smart cities for the inclusion of older people. If social innovations "are innovations that are social in both their ends and their means" and "are not only good for society but also enhance individuals' capacity to act" (European Commission, 2013, p. 6), it is possible to perceive the advantages of participation as a mean and of participation as an end. This can be done by organising real and living opportunities to mix social servants, researchers, service providers, and citizens in "living labs" to find new solutions for new problems in a dynamic and interactive way. "Living Labs (LLs) are defined as user-centered, open innovation ecosystems based on systematic user co-creation approach, integrating research and innovation processes in real life communities and settings."[2] It is not by chance that the idea of Living Labs was originally formed to involve city dwellers more actively in urban planning and city design (Mitchell, 2005), and the increasing examples of the use of this methodology are mainly settled at the micro or meso level, i.e., the everyday life level in which older people try to give a meaning to their lives and find a solution to their needs.

[2] This is the official definition proposed by the European Network of Living Labs (https://enoll.org/about-us/).

3 Technology and Ageing Between Care and Participation: From the Deterministic Model to the Social Construction of Technology

The concept of social participation mentioned above includes two different aspects: participation in decision-making processes and participation in the design of interventions, goods, and services. In contemporary societies, technology plays an important role in supporting the participation of older people and introduces involvement in the process of design, testing, and the implementation of technological devices.

Since there is a strong correlation between social participation and technology in the smart city, it is useful to analyse the relationship between older people and technology and the barriers that limit its development in order to design appropriate policies to improve levels of participation.

In analysing the role of technology in the participatory processes of senior citizens, it is necessary to make a distinction between technology-mediated social participation and assistive technology. Technology-mediated social participation refers to modes of participation using technological tools that are expressed on different levels: reading, contributing, collaborating, and leading. The highest level is participation in governance by setting and upholding policies (Preece & Shneiderman, 2009). Assistive technology, on the other hand, relates to the use of technological devices to enhance the participation of people with disabilities and elderly populations (World Health Organization [WHO], 2016).

In the case of technology-mediated social participation, which most often involves active seniors, the process takes the form of the Living Lab; in the design of assistive technology, citizen involvement is less widespread and follows a top-down path with the risk of achieving low rates of acceptance or even rejection (Hurst & Tobias, 2011). Both forms characterise the smart city. The smart city is certainly technological, but it also encompasses changes in social relations, which are fundamental to making the city sustainable and promoting community well-being. Not by chance, social participation is one of the characteristics that describe the smart city in terms of smart people, smart governance, and smart living: participation in public life, participation in decision-making, transparent governance, affinity to lifelong learning, cultural facilities, education facilities, social and ethnic plurality, and social cohesion are all specific indicators of the general concept of participation in the smart city (Giffinger & Gudrun, 2010).

Social participation is strongly connected to one's well-being throughout life: it not only enables older people to maintain a good level of social integration but is also a factor in maintaining health and cognitive functions. Therefore, social participation is crucial in regards to the well-being of older people; however, it is becoming increasingly dependent on technology use.

The literature contains several examples of frameworks or models that describe how people's online behaviour changes over time (Preece & Shneiderman, 2009); however, the relationship with technology depends on both subjective and objective factors. Age connects to the digital divide in at least two ways. First, age is an

independent variable because it influences access to and use of technology; as age increases, familiarity and use of technology diminishes and inequalities are reinforced. Second, age acts as a dependent variable because of geographical disparities regarding access to technology. The diffusion of internet has a geographic variance. According to the urban density theory, the internet follows a pattern of diffusion that first favours urban areas (Forman et al., 2005). From the point of view of population mobility, contemporary urbanisation is characterised by generational mobility that moves older people away from central areas and increases social exclusion and marginalisation (Beck, 1998). The presence of both these factors causes a higher degree of digital divide among older people than in other groups.

Older people have a different relationship with technology than other clusters: they use a smaller number of devices, have a lower frequency of use, and access the internet far more rarely (European Commission & Eurobarometer, 2019, 2020a, b). Furthermore, the are differences in the rural/urban dimension: those living in cities access the internet more often than those living in rural villages (European Commission & Eurobarometer, 2019). This is caused by persistent and growing differences in infrastructure between urban and rural areas. In addition, technology has an economic impact; given that affordability is lower among seniors, the gap between those who will benefit from technological advances and those who will be excluded from them is increasing.

The peculiarities of the relationship between older people and technology do not only concern the possession of devices and the way and frequency of use, but also the perception of aspects of concern, such as the security of data and online transactions and the prospect of someone misusing another's personal data. For this reason, older people believe more than others that public policy intervention is needed to ensure the safety and ethical development of technology, especially in the case of artificial intelligence applications (European Commission & Eurobarometer, 2019, 2020a, b, c).

Although older people present a slightly different approach to technology than other social groups, they are not a homogeneous group when it comes to the use of technology, or the internet in particular (McDonough, 2016). The different generations of older people have a different relationship with technology that depends on how the process of socialisation with technological objects has been realised.

According to technological determinism, technology is the factor that explains the transformation of society but the entry of technology in daily interaction is not a linear process and is patterned by a range of social factors.

As discussed by MacKenzie and Wajcman in the framework of "Social Shaping of technology" (1999), technology and society cooperate in the process of social integration. In a similar manner, the "Social Construction of Technology" approach rewrites the deterministic model based on the unidirectional impact of technology and states that technology is born without a precise characterisation, assuming different conformations based on the comparison between social groups (Bijker et al., 1987). The process of socialisation with technology takes place in four phases: appropriation, objectification, incorporation, and conversion (Silverstone & Hirsch, 1992). The way this process occurs influences the probability of the technological device

being used or, on the contrary, of its abandonment (Operto, 2018). The ultimate aim of this process must be, according to Visvizi and Lytras (2018a, b), the transition from Technology Enablers to Social Awareness because a positive effect of New Technologies must be built and not taken for granted.

It is important to take into account the characteristics of the process of socialisation of older people with technology in order to use all the advantages offered and reduce the barriers that limit development of social participation. The advantages of the diffusion of technology among older people are many, especially in societies characterised by the break-up of the traditional family: reduction of isolation, inclusion, active ageing, maintenance of independence, permanence in one's own home, access to services and information, prevention, and assistance.

In recent years, there has been an acceleration in the development of telecare/smart homes, pro-active service systems, household robots to robot-assisted therapy, socially assistive robots, wearable technologies for monitoring, and prevention; this acceleration has stimulated studies and publications on the interaction with robotic agents in smart home environments.

Additionally, it is even more important to structure policies aimed at increasing the active use of technology for participation practices and digital citizenship. Working in this direction can help to overcome the typical "deficit model" stereotype, essentially referred to as the medicalisation of ageing itself (Fulop et al., 2019) for less autonomous senior citizens.

The spread of technology among the elderly has macro and micro barriers. The macro barriers are linked to the lack of adequate infrastructure in certain regions and the difficulty of having technological devices for the highest economic fragility. Micro barriers refer to the absence of computer literacy, which may reinforce existing inequalities that increase distrust towards technology.

Older people are more exposed than others to fragility, marginality, exclusion, and economic and cultural poverty. It is necessary to imagine programmes based, above all, on the diffusion of lifelong learning to reduce the digital divide. It is also necessary to integrate strategies because of the presence of social, economic, legal and, last but not least, ethical aspects.

Social capital is a fundamental element for the growth of the smart city; greater integration between the elderly and technology could encourage the growth of forms of cooperation between different social actors to achieve vertical and horizontal forms of e-governance. From the convergence between social capital and technology, a new possibility is thus formed: Socio-Technical Capital, a theoretical construct with provides a framework for describing the technology-mediated forms of social participation (Resnick, 2002).

Because the technological process is rapid and difficult to predict, it will be interesting to observe how the population turnover will contribute to this phenomenon when the younger generations approach the older condition: generation X first, then, in a few decades, generation Y, the cohort of digital natives.

The rapid changes we are witnessing require profound and shared reflection on the relationship between science and governance, as well as the choices and policies that will result to improve citizenship, participation, and human enhancement.

4 Conclusions

The growing literature on smart cities focuses on a few key points that are also relevant in our concluding remarks.

The first point is the impossibility to separate sustainability, the use of technology, and happiness (see, e.g., Visvizi & Lytras, 2020; or, recalling Dahrendorf (1995), to ensure social cohesion, economic development, and political freedom at the same time. This means that positive actions to counter and reduce the gap that the evolution of technology creates between weak and strong groups and among geographical areas in the contemporary world must be activated. And elder people are one of the most important social group to be defended and to be empowered.

The second point is how to ensure political participation, or political freedom. It is a matter of fact that the growing role of IoT on one hand and of AI on the other can expropriate people from the ability to infer from the information of the guidelines of action, which risks the building of a world already thought and decided before and behind human intervention. Moreover, the challenge to use technology in a deliberative, democratic way is very strong, and the ways it can implement, thanks to new technologies, participation in decision-making and technology development are very important for a sustainable smart city (see Visvizi & Lytras, 2018b).

For sure, such issues will become more and more determining factors in the development of effective and efficient smart cities environments, due both to the and new ways of being senior citizens in the diffused demographic ageing process, as well to the continuous advancement of technology-driven lifestyles.

Acknowledgements While the contribution derives from several discussions between the authors, Stefano Poli is the author of the first chapter, "Introduction: living older in contemporary urban context: ageing in place, technology and heterogeneity among older people," Mauro Palumbo is the author of the second chapter, "Ageing, technology and social participation," and Stefania Operto is the author of the last chapters, "Technology and ageing between care and participation: from the deterministic model to the social construction of technology" and "Conclusions."

References

Beck, U. (1998). *Democracy without enemies.* Polity.

Bijker, W., Hughes, T., & Pinch, T. (eds.) (1987). *The social construction of technological systems: New directions in the sociology and history of technology.* MIT.

Butler, T., Hamnett, C., & Ramsden, M. (2008). Inward and upward: Marking out social class change in London, 1981–2001. *Urban Studies., 45*(1), 67–88.

Chesbrough, H. W. (2006). Open innovation: A new paradigm for understanding industrial innovation. In H. W. Chesbrough, W. Vanhaverbeke, & J. West (Eds.), *Open innovation: Researching a new paradigm* (pp. 1–12). Oxford: Oxford University Press.

De Cindio, F., Palumbo, M., Ribaudo, M., & Torrigiani, C. (2014). The university in the polis: an emerging role of democratic intermediary in e-participation? In *Proceedings of AIS 2014—XI conference of the Italian chapter of AIS—Digital innovation and inclusive knowledge in times of change* [Online]. Available from: http://www.cersi.it/itais2014/

Congiu, D., Freddano, M., & Palumbo, M. (2012). Participation in local decision-making. In: G. O. Tsobanoglou (Ed.), *The politics of participation and empowerment: current issues and practices* (pp. 72–87). Verlag fur Gesellschaftsarchitektur, GmbH.

Cossetta, A., & Palumbo, M. (2014). The co-production of social innovation: the case of living lab. In R. P. Dameri & C. Rosenthal Sabroux (Eds.), *How to create public and economic value with high technology in urban space* (pp. 221–235). Springer.

Dahrendorf, R. (1995). *Quadrare il cerchio. Benessere economico, coesione sociale e libertà politica.* Laterza.

European Commission. (2013). *Guide to social innovation. DG regional and urban policy and DG employment, social affairs and inclusion.* Available from: social_innovation_2013.pdf (europa.eu).

European Commission, Directorate-General for Migration and Home Affairs and Co-Ordinated by the Directorate-General for Communication. (2019). *Europeans' attitudes towards Internet security* [Online]. Special Eurobarometer 480. Available from: https://doi.org/10.2837/224814

European Commission, Directorate-General for Migration and Home Affairs and Co-Ordinated by the Directorate-General for Communication. (2020a). *Europeans' attitudes towards Internet security* [Online]. Special Eurobarometer 499. Available from: https://doi.org/10.2837/672023

European Commission, Directorate-General for Migration and Home Affairs and Co-Ordinated by the Directorate-General for Communication. (2020b). *Attitudes towards the impact of digitalisation on daily lives* [Online]. Special Eurobarometer 503.

European Commission, Directorate-General for Communication. (2020c). *Europeans and artificial intelligence.* Standard Eurobarometer 92. Available from: https://ec.europa.eu/commfrontoffice/publicopinionmobile/index.cfm/Survey/getSurveyDetail/surveyKy/2255

Forman, C., Goldfarb, A., & Greenstein, S. M. (2005). Geographic location and the diffusion of internet technology. *Electronic Commerce Research and Applications, 4*(1), 1–13. Available from: https://doi.org/10.1016/j.elerap.2004.10.005

Fulop, T., Larbi, A., Khalil, A., Cohen, A., & Witkowskii, J. (2019). Are we ill because we age? *Front Physiol, 10*, 1508. Available from: https://doi.org/10.3389/fphys.2019.01508

Giffinger, R., & Gudrun, H. (2010). *Smart cities ranking: an effective instrument for the positioning of the cities.* ACE: Architecture, City and Environment.

Green, B. (2006). *Marketing to leading-edge baby boomers: Perceptions, principles, practices, predictions* [Online]. Paramount Market. Available from: ISBN 0976697351.

House, E., & Howe, K. (2000). Deliberative democratic evaluation. In E. Ryan & L. De Stefano (Eds.), *Evaluation as a democratic process, new directions for program evaluation* (Vol. 85). Jossey Bass.

Howe, N., & Strauss, W. (1991). *Generations: The history of Americas future, 1584 to 2069* [Online]. William Morrow. Available from: ISBN 0-688-11912-3.

Hurst, A., & Tobias, J. (2011). Empowering individuals with do-it-yourself assistive technology. In: *The proceedings of the 13th international ACM SIGACCESS conference on Computers and accessibility (ASSETS 2011)* (pp. 11–18). Association for Computing Machinery. Available from: https://doi.org/10.1145/2049536.2049541

Jones, I., Hyde, M., & Victor, C. (2008). *Ageing in a consumer society.* Policy.

Kahane, D., Loptson, K., Herriman, J., & Hardy, M. (2013). Stakeholder and citizen roles in public deliberation. *Journal of Public Deliberation*, *9*(2).

Karpowitz, C. F., Raphael, C., & Hammond, A. S. (2009). Deliberative democracy and inequality: Two cheers for enclave deliberation among the disempowered. *Politics and Society., 37*, 576–615.

Leach, R., Phillipson, C., Biggs, S., & Money, A. (2008). Sociological perspectives on the baby boomers: An exploration of social change. *Quality in Ageing and Older Adults., 9*(4), 19–26.

Lindblom, C. E., & Braybrooke, D. (1963). *A strategy of decision.* The Free Press.

Mackenzie, D., & Wajcman, J. (Eds.). (1999). *The social shaping of technology.* Open University Press.

March, J. G., & Olsen, J. P. (1976). *Ambiguity and choice in organizations.* Universitetsforlaget.

Mccreadie, C. (2013). Technology and older people. In D. Dannefer & C. Phillipson (Eds.), *The sage handbook of social gerontology* (pp. 607–617). Sage.
Mcdonough, C. (2016). The effect of ageism on the digital divide among older adults. *Journal of Gerontology and Geriatric Medicine, 2*(6), 2–7. Available from: https://doi.org/10.24966/GGM-8662/100008
Mitchell, W. J. (2005). Constructing complexity. In B. Martens & A. Brown (Eds.), *Computer aided architectural design futures* (pp. 41–50). Springer Netherlands.
Murray, R., Caulier-Grice, J., & Mulgan, G. (2010). *The open book of social innovation: Ways to design, develop and grow social innovations*. National Endowment for Science, Technology and the Art.
Operto, S. (2018). Human, not too human: Technology, rites, and identity. *On Open Information Science, 2* (1), 189–202. Available from: https://doi.org/10.1515/opis-2018-0015
Pakulsky, J. (2007). Foundations of a post class analysis. In E.O. Wright (Ed.), *Approaches to class analysis*. Cambridge University Press.
Palumbo, M. (2009). I poteri locali tra governance e partecipazione. In M. Palumbo & C. Torrigiani (Eds.), *La partecipazione tra ricerca e valutazione* (pp. 11–36). FrancoAngeli.
Phillipson, C. (2013). Ageing and the urban society: Growing old in the century of the city. In D. Dannefer & C. Phillipson (Eds.), *The sage handbook of social gerontology* (pp. 597–606). Sage.
Phills, J. A., Deiglmeier, K., & Miller, D. T. (2008). Rediscovering social innovation. *Stanford Social Innovation Review., 6*(4), 34–43.
Preece, J., & Shneiderman, B. (2009). The reader-to-leader framework: Motivating technology-mediated social participation. *AIS Transactions on Human-Computer Interaction., 1*(1), 13–32.
Resnik, P. (2002). Beyond bowling together: SocioTechnical capital. In J. M. Carroll (Ed.), *Human-computer interaction in the new millennium* (pp. 647–672). ACM Press.
Richards, R. C. Jr., & Gastil, J. (2015). Symbolic-cognitive proceduralism: a model of deliberative legitimacy. *Journal of Public Deliberation*, *11*(2).
Silverstone, R., & Hirsch, E. (Eds.). (1992). *Consuming technologies: Media and domestic practices*. Routledge.
Tormey, S. (2015). *The end of representative politics*. Polity.
Visvizi, A., & Lytras, M. D. (2018). Policy making for smart cities: Innovation and social inclusive economic growth for sustainability. *Journal of Science and Technology Policy Management., 9*, 126–133.
Visvizi, A., & Lytras, M. D. (2018). Rescaling and refocusing smart cities research: From mega cities to smart villages. *Journal of Science and Technology Policy Management., 9*(2), 134–145.
Visvizi, A., & Lytras, M. D. (2020). Sustainable smart cities and smart villages research: Rethinking security, safety, well-being, and happiness. *Sustainability, 12*(215), 1–4.
Wiles, J., Leibing, A., Guberman, N., Reeve, J., & Allen, R. (2011). The meaning of "aging in place" to older people. *The Gerontologist, 52*(3), 357–366. Available from: https://doi.org/10.1093/geront/gnr098.
World Health Organization [WHO] (2016). *Improving access to assistive technology: Report by the secretariat* [Online]. Executive Board, 139. Available from: https://apps.who.int/iris/handle/10665/250595

Stefano Poli Ph.D., Associate Professor of Sociology, University of Genoa. His research interests include social inequalities, methodology, social gerontology. Mauro Palumbo, Ph.D., Professor Emeritus in Sociology, University of Genoa, Genoa, Italy. His research interests include evaluation, social inequalities, methodology.

Mauro Palumbo Professor Emeritus in Sociology, University of Genoa, Genoa, Italy. His research interests include evaluation, social inequalities, methodology.

Stefania Operto Ph.D., Professor in Sociology, University of Genoa, Genoa, Italy. Her research interests include Human Robot Interaction (HRI), Science and Technology Studies (STS), Social science Methodology.

Stakeholder-Based Management of Smart Cities: The Case of Brussels

Samedi Heng, Delphine Cheng, Konstantinos Tsilionis, and Yves Wautelet

Abstract Large cities around the world have been devoting a lot of effort and resources in becoming 'smart'. Even though series of initiatives have been taken, still within the premises of a specific city, digital advancement projects have been often conceived in silos with the focus being only on one or a few particular stakeholder(s) with no global coordination. Nevertheless, in order to be successful, smart cities need to evaluate consistently the projects in their portfolio and assess their impact on different stakeholders. This chapter identifies the stakeholders playing a central role in the city of Brussels and represents their intentions using the goal-oriented models of the i* framework while surveying the adequacy of each of the stakeholders' goals on the achievement of the strategic objectives of a smart city development. The analysis suggests sustainable mobility, citizen participation and collective governance as the three main strategic objectives.

Keywords Smart cities · Stakeholders · Brussels · i*-based modeling

1 Introduction

Nowadays, cities have to face multiple challenges necessitating global cooperation to develop a consistent business ecosystem, i.e., business firms, visitors, Foreign Direct Investments (FDIs), etc. (Caragliu et al., 2015). In addition, urbanisation is a common phenomenon for many countries (Kashnitsky et al., 2020); cities are confronting new kinds of problems such as social inequality, waste management challenges, resource scarcity, air pollution, human health concerns, traffic congestions and inadequate infrastructure (Marceau, 2008). Consequently, an urban population growth combined with an increase in cities' economic and political importance is accompanied by the growing need for adequate governance structures. Therefore, the purpose of a 'smart

S. Heng (✉)
Université de Liège, Liège, Belgium
e-mail: samedi.heng@uliege.be

D. Cheng · K. Tsilionis · Y. Wautelet
KU Leuven, Leuven, Belgium

A. Visvizi and O. Troisi (eds.), *Managing Smart Cities*,
https://doi.org/10.1007/978-3-030-93585-6_12

city' is becoming even more essential because by implementing such a design, the government is able to cope with both local and global challenges while being capable of employing the available resources in a way that maximises overall welfare and sustainable growth (Caragliu et al., 2015).

The concept of a smart city has evolved along the years to be comprised of numerous orientations yielding diverse views of what a smart city is (or could be) rendering smart solutions more of a puzzle than a tangible offering (Desdemoustier et al., 2019; Visvizi & Lytras, 2019). More importantly, for many years, the debate concerning smart cities seemed to remain separated from the broader socio-political and economic attributions (Visvizi et al. 2018; Lytras & Visvizi, 2020; Lytras et al., 2020). Nonetheless, the emergence of technologies such as Internet of Things (IoT), machine learning, etc., has become fundamental on how cities can provide different types of response to urban and territorial challenges. However, despite the rise of smart technologies, stakeholders may still understand the perception of a smart city differently and appropriate the idea in their own way (Hollands, 2008; Lytras et al., 2020).

As making the city smart is becoming increasingly important in Belgium, the purpose of this research is to use organisational modelling and more specifically the i* framework (Yu et al., 2011) to represent the requirements and expectations of each stakeholders involved in a smart city realisation project. Indeed, there is a need to adopt both a management as well as an interdisciplinary perspective, while at the same time understand how the complex ecosystems instigated by a smart city project integrate social, economic, ecological and political subsystems. The aim of using conceptual models in supporting organisational actors with their problem-solving processes is not new. For instance, business process diagrams have been used by managers to reengineer aspects of their organisation and discover inefficiencies for over a decade (Hammer & Champy, 2001). Therefore, this research aims to answer the following research question:

In what ways would conceptual modeling help identifying the goals and intentional behavior of a smart city's stakeholders?

Identifying stakeholders (and their varying interests) is essential to face the challenges of a smart city implementation and its governance. In this context, we aim to answer our research question by choosing one among the 19 municipalities within the Brussels' region as case study; for privacy reasons, the name of this municipality will not be presented within this research.

For the purposes of this study, we consider smart cities as the new socioeconomic environments in which citizens, enterprises, and governments can access services and resources more efficiently. They can be perceived as alternatives to traditional planning modes, using new technologies (especially ICT) to tackle various problems such as traffic congestion, air pollution or social inequality (Alawadhi et al., 2012). Moreover, for the context of this research, smart technologies will be regarded to have the capacity to transform civil and private services by integrating real-time communications, citizens' needs and information, and by enhancing liveability (Ben Letaifa, 2015). The sections below will depict in detail the use of conceptual modelling as

a mapping tool to characterize the actors and their dependencies in the setting of a smart city (organizational) environment.

2 The i* Framework

The i* framework is an agent-oriented and goal-oriented graphical requirement modelling notation (Yu et al., 2011). It allows for an early requirement engineering analysis in environments where social actors depend on each other for goals to be achieved, tasks to be performed, and resources to be furnished (Yu et al., 2011). Previous research emphasized on the relevance and utility of i* to model organizational requirements of a 'multi-agent system' (Wautelet et al., 2018a), facilitating stakeholder interactions by depicting their dependencies and hence providing a medium for coordination. i* was previously used to model several organizational settings such as online stores (Kolp et al., 2011), hospital beds management (Wautelet et al., 2018a; Wautelet, 2019), health care (Yu et al., 2011), supply chains and more specifically outbound logistics (Wautelet, 2012), and production support in the steel industry (Wautelet et al., 2018b; Kolp et al., 2008). The framework was also utilized for the development of higher education platforms like collaborative learning software (Kolp & Wautelet, 2015) and Massive Open Online Courses (MOOCs) (Wautelet et al., 2016). On the one hand, by mapping the goals, the model becomes a reference point as it comes to the assessment of the project progress. On the other hand, the focus on actors directly involved in goals' achievement allows the analysis of 'strategic intents' of agents (Yu et al., 2011). Hence, the provision of a model that helps to visualize the whole actors' network configuration would allow the functional analyst to better understand the different roles, responsibilities and relations of each node leading to more adequate decision making. The i* framework is divided in two parts, each providing a different level of abstraction: The Strategic Dependency (SD) and the Strategic Rationale (SR) model (Yu et al., 2011). This framework has been extended to the new version called iStar 2.0 (Dalpiaz et al., 2016). Figure 1 provides the core concepts and legend of the iStar 2.0 framework. The SD model shows dependencies and the SR model depicts internal intents.

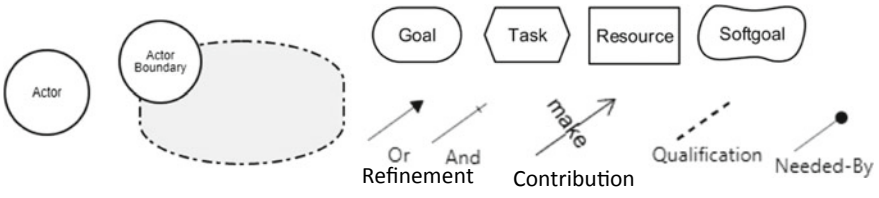

Fig. 1 Relevant i* 2.0 concepts and legend

3 Research Design

3.1 Research Methods and Data Collection

In order to develop the SD and SR models representing and analysing the interests of stakeholders in smart cities, we followed the approach proposed by Yin (2003). It consists of three principles: (1) use multiple sources of evidence, (2) create a case study database and (3) maintain a chain of evidence.

The first principle necessitates the obtainment of multiple sources of evidence. We used exploratory and semi-structured interviews with stakeholders who were involved or experienced in smart cities projects in order to fulfil this requirement. The 'Quadruple Helix model' (Finquelievich et al., 2016) recognises four different types of stakeholders in a smart city; these can be perceived as independent entities interacting with each other. They can be distinguished in central government or local authorities, industries, universities, and citizens. The list with the conducted interviews is presented in Table 1. In essence, an exploratory interview of twenty minutes was organized with an alderman, in charge of the municipality's digital transformation. Additional semi-structured interviews were conducted with five other participants in a forum on smart cities; the interviews lasted five to twenty-five minutes depending on each participant's availability. The interviews were performed either in French or English, and were voice recorded on a mobile device with the permission of the interviewees. The interview questions were focused on each participant's role, initiatives, challenges, and vision for the future of the municipality. The interviewees' names are not presented here for privacy reasons.

The second principle refers to the creation of a case-study database. During the conducted interviews, we collected data via note-taking, complemented with audio recordings. This primary source of data was complemented by using secondary data in the form of information, retrieved from numerous scientific journals, conference papers, policy reports, and lastly websites. Most of the secondary data sources are from the mid-2000s and are as recent to 2019. The information retrieved helped

Table 1 Overview of conducted interviews

Interviewee Nr	Organisation	Interviewee role	Date
Interviewee 1	Case municipality	Alderman	April 2019
Interviewee 2	Brussels Informatic Regional Centre (BRIC)	Brussels state secretary	March 2019
Interviewee 3	BEP Namur	Smart city project leader	March 2019
Interviewee 4	Agoria	Business group leader	March 2019
Interviewee 5	BNB Paribas	Head of sustainable business competence centre	March 2019
Interviewee 6	Jules Lesmart—NRB	Mister #smart city	March 2019
Interviewee 7	Sibelga	Public lighting supervisor	March 2019

us understand some aspects that were not made clear during the interviews or not brought up by the interviewees but could present useful additional added value to the data collection process and analysis.

Finally, past studies have shown that goal-oriented requirements engineering can be indeed adapted to model strategic objectives. Thus, once the textual descriptions of each participant's interests were sorted, they were modelled with the use of the i* framework notation to get a holistic picture of the strategic drivers.

4 Case Study

In Belgium, the institutional structures of the country are based on centrifugal federalism; the federal state is based on three linguistic and cultural communities (the Flemish, French and German-speaking communities) and three regions (Flanders, Wallonia and Brussels-Capital) (Deschouwer & Reuchamps, 2013). The regions are responsible for matters concerning territorial subjects such as regional planning, environment, transport (except railways), and regional economic development. At the same time, Communities are responsible for matters relating to education, culture, healthcare, family or any other Person-related field. Municipalities are under the regulatory authority of the regions (Desdemoustier et al., 2019).

Brussels in particular, is in line with the DESI (Digital Economy and Society Index) indicators of the European Union. Indeed, the 2014–2019 regional policy stated the government's intention to transform the region of Brussels-Capital into a smart city. The 'Brussels Smart City' official website describes as a major strategic goal the dissolution of various urban development challenges through the use of technology. This process must simultaneously stimulate innovation and the involvement of public services, citizens, businesses and the academic world (Brussels Regional Informatics Centre official website). These goals can be nested under the same intentions provided by different authors in the literature (Nam & Pardo, 2011, Griffinger et al., 2007).

The main objective of Brussels Smart City to meet the urban development challenges of the Brussels-Capital Region will be approached through three fundamental dimensions (Brussels Smart City, 2020):

- Sustainable development in response to ecological issues;
- Human development in response to social issues;
- Economic development in response to the issues of prosperity.

The case municipality is mostly a residential area with more than forty-thousand inhabitants on a territory of about 9km^2. The local municipality's governance has appointed a city councillor for developing its smart city strategy. The councillor serves as a focal point so as to inspire and reunite the different parties in order to create aggregate value and maximise all efforts towards the obtainment of common objectives.

Recently, the local authorities of the case municipality have published their Public Statement for the political period 2019–2024, including the objective of becoming a smart city. They want to transform the municipality in a sustainable territory which offers high standards of living. This is in agreement with the study of Axelsson & Granath (2018) mentioning that the determination of a city's strategy and its principal objectives are an essential starting point for any smart city action. For the following five years, the municipality wants to focus on an ecological and digital transition through citizen participation and new technologies. In general, its local authorities want to offer a greener and smarter municipality which is in close relation with what the region of Brussels proposes as well.

5 Results: Smart Cities Models

The initiatives presented by the case municipality cannot be achieved without a proper stakeholder-management approach. The latter indicates that during the establishment of strategic objectives and all decision-making processes related to their fulfilment, different groups of individuals (stakeholders) should be taken into account to maximise shared value.

In fact, Fernandez et al. (2018) emphasize that the every conceptual model in regards to a smart city project should organize its decision-making processes around the satisfaction of key stakeholder interests. Therefore, our defined methodology used data collected from the interviews and information obtained from different secondary sources to determine various stakeholders' interests and to model them. It is important to notice that each city has their own priorities and goals. Ultimately, our analysis identified three major interests: (1) Mobility, (2) Citizen Participation and (3) an Engaging Collaboration.

6 The Stakeholder's Interests

At the strategic level, the smart city implies four different actors (i.e., stakeholders); these are: the municipality, the companies, the research centres and universities, and finally the citizens. The Municipality can be considered at the highest hierarchical level and the one that elaborates the different initiatives; the Universities and Research centres are the one with the most accumulated knowledge in terms of a smart city implementation project; Companies (and IT industry in general) are the ones providing solutions to the initiatives; lastly, Citizens play a crucial role as they are the ones who will benefits from all the projects.

The intentions of stakeholders (implicated in a smart city project) are modelled as goals depicting that the citizens depend on the municipality – it can be perceived as a formation representing the college of Mayor and aldermen – for a sustainable well-being. Conversely, the municipality depends on citizens and their participation

in social activities at the local environment. The citizens provide data so companies can offer new product development and innovation to municipalities or by adapting its existing information technology systems. This is necessary for the municipality to conclude a smart collaboration with companies. The municipality also depends on research centres for a collaborative system and it receives in exchange practical information on matters of smart initiative implementations.

7 Sustainable Mobility

A common interest drawn from several interviews with public authorities, companies (and validated with the use of secondary data sources) is the subject of mobility. Indeed, traffic is a major concern in large cities. Traffic congestion not only leads to accidents but also to an excessive amount of CO_2 emissions. Therefore, the goal of transforming cities into a better version of themselves encompassing a working and sustainable mobility plan is not only valid but necessary. The achievement of this goal requires the implementation of policies, actions and decisions that would favour the integration of a sustainable mobility design within the outcomes of a local government (Da Silva et al., 2008).

In fact, an improved and functional mobility plan would attract businesses and investors for the local community and it would eventually create jobs, generate activities and accommodate new inhabitants. Let alone, the attraction and facilitation of tourists due to a more sustainable mobility is also an important source of revenue for a whole segment of the local economy and consequently, for the municipality itself.

Incidentally, the first Interviewee plans to implement projects on sharing public spaces, improving life and air quality as well as mobility. For instance, the local government has already set up a number of smart traffic lights near schools, turning red whenever a car exceeds the speed limit. This project is still in its testing phase and conditional to a successful implementation on a small scale, it holds the potential of being implemented in the entire region.

Moreover, a few applications have already been implemented for citizens to use. To name a few, 'Koalift' is an application offering a service of carpooling for parents while 'FixmyStreet' is an application enabling people to report issues related to public infrastructure such as broken traffic lights in the city or cases of vandalism.

Mobility is also a major issue for the whole region of Brussels-Capital. In particular, the second interviewee, holding the role of the State Secretary in Brussels in charge of the IT policy and of BRIC, cited the real need to fight against global warming and the quality of Brussels' air. Hence, one of the main interests of the stakeholders is to tackle the issue of pollution and especially urban traffic flow. These concerns can be addressed with the use of innovative technologies and energy saving techniques to improve air quality and by installing smart traffic cameras. The latter has already shown some impressive results in the low-carbon emission area of Brussels where for the last six months, the fine particle and the emissions of nitrogen oxides have dramatically diminished. These cameras/radars have a twofold purpose; on the

one hand, they are placed to control air quality; on the other hand, they serve as a precautionary technique to decrease roads accidents.

Technologies as such (i.e., smart cameras) take advantage of the third and fourth industrial revolutions where the use of ICT, the Internet, wireless technologies, etc., have moved the world into a new era where an excessive amount of data is being generated and transferred at an infinitely small time increment. Indeed, every digital process and social media activity produces an abundance of data where at a later stage they can be transmitted by sensors, mobile devices, etc. (Caputo et al., 2019). These data are collected, stored and analysed in order to improve traffic flow and better harmonise the various transportation methods. This comes in line with previous studies such as the one of Appio et al. (2019) mentioning that one of the key motivations of smart city projects is to improve the current state of traffic congestion.

Now that the main stakeholders and their relevant goals have been identified (Fig. 2), we select the first interest of the stakeholders (sustainable mobility) to be developed in the i* SR diagram (Fig. 3).

The analysis focuses on the top-level of the local government. As the municipality is interested in mobility, its different goals are to offer mobility alternatives, improved air quality and life quality to its inhabitants. To achieve those goals, it has also the intention to work in collaboration with two other stakeholders: the IT industries and BRIC.

The analysis of the different tasks also shows that the IT industry needs to propose their technologies to the municipality, and at the same time, the municipality needs

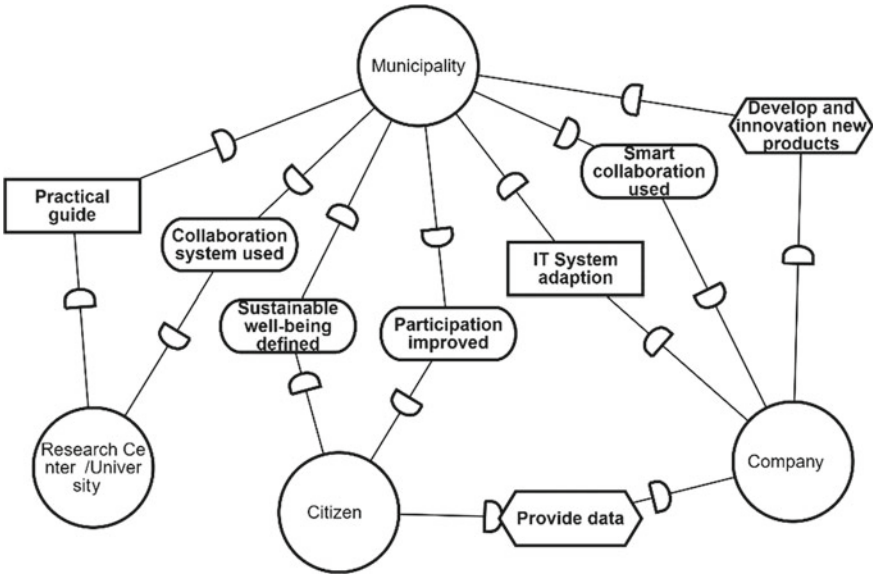

Fig. 2 Strategic Dependency diagram of the municipality

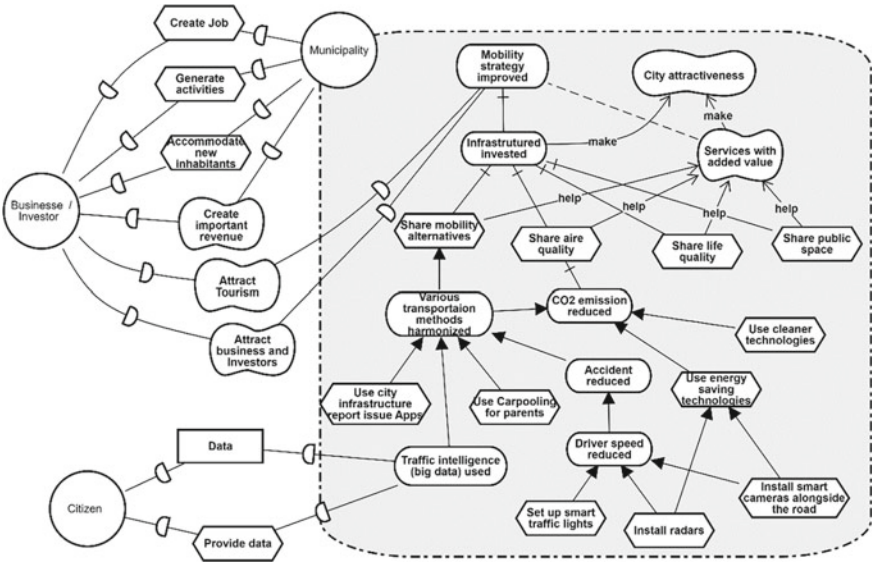

Fig. 3 i* Strategic Rationale diagram of mobility

to take political decisions and make investments in order to reach the goal of an improved sustainable mobility. Moreover, using the sensors built and used in the city, the municipality would be able to collect information, store the data, analyse them and present these results and their accompanying insights in some kind of reports that would demonstrate some main trends in citizens' behaviour and eventually some future projections.

8 Citizen Participation

The second interest that was dominated among the stakeholders' concerns is the issue of citizen participation in a smart city. For instance, one of the objectives published in the Public Statement of the municipality is to improve citizens' quality of life using technologies. Indeed, an active engagement on behalf of citizens and actors in urban governance helps to create higher public value (Bolívar, 2017). Governance and collaboration are also crucial for smarter cities as they reflect how public value can be created with the participation of citizens and other social actors (Gil-Garcia et al., 2016).

According to the feedback obtained during the semi-structured interview with the third interviewee, a smart city project manager, local authorities are lagging behind in their technological development compared to the citizens. Therefore, there is still a lot of work to be done at the level of governance to produce a valuable outcome for its citizens.

Thus, in the case municipality, in order to improve the municipality's digital communication with citizens, the first interviewee wants to develop a pilot project in collaboration with an IT company that defines the creation of a chatbot that would facilitate the use of governance services for its residents. As an example, citizens could ask directly their questions to this chatbot whenever they want to validate their parking card or receive some other official documents from the municipality's website. An extended version of this project would render this chatbot available on other online platforms such as Facebook or WhatsApp. This would positively increase user experience according to the first interviewee.

An application already used by the municipality is 'Fluicity' allowing for online citizen participation. In fact, citizens can propose projects for the municipality or give their opinion on initiatives taken by the local authorities. The application creates in this sense interactivity between the local authorities and its citizens. Furthermore, in order to keep its residents aware of the various projects conducted, the municipality uses mainly its newsletters, social networks or even its territorial billboards.

To increase citizen participation, the municipality has also created a small hub for its inhabitants in order to promote entrepreneurship and advertise projects related to sustainable development and sustainable digitalisation.

It is also crucial to include the elderly generation when developing smart city initiatives. This can be achieved for instance, by creating a 'municipal platform for intergenerational assistance'. Via this platform, the seniors could directly ask their questions or ask for services that would be realised by younger individuals. As an example, students could help their elders with their groceries and in return, they would receive some help with their homework. This idea would eventually tackle the issue of seniors' isolation and marginalisation. Moreover, in order to fight the digital gap between the young and the old generation, another initiative offered by the municipality is to offer classes and tutorials on how to use new technologies for the elderly people.

To conclude, there is a general agreement that the concept of smart city could help to make a municipality or a region more sustainable, closer to its residents and increase its overall well-being of the population. Thanks to the efforts of the democratisation of modern technologies, it has been possible for citizens to be more vocal about issues that are important for them (Walravens, 2015). Consequently, this has led to new services that simplify the communication between citizens and governments and has also resulted in new methods in academia aimed at including a user perspective when developing new tools and application (co-creation, Living Lab). An increased involvement of the citizen is often referred as an integral part of the city of tomorrow (Hemment & Townsend, 2013).

The i* SR diagram for citizen participation is illustrated in Fig. 4. It focuses on the goal dependency between actors Municipality, citizens and the IT industries, namely citizen participation.

To achieve that goal, the rationale analysis requires three sub-goals; (1) citizen engagement, (2) public value creation, and (3) the transition to e-governance services that would be realised and fulfilled by the above actors. For each goal, there are tasks decomposed in subtasks, whose collective fulfilment completes the task. Figure 4

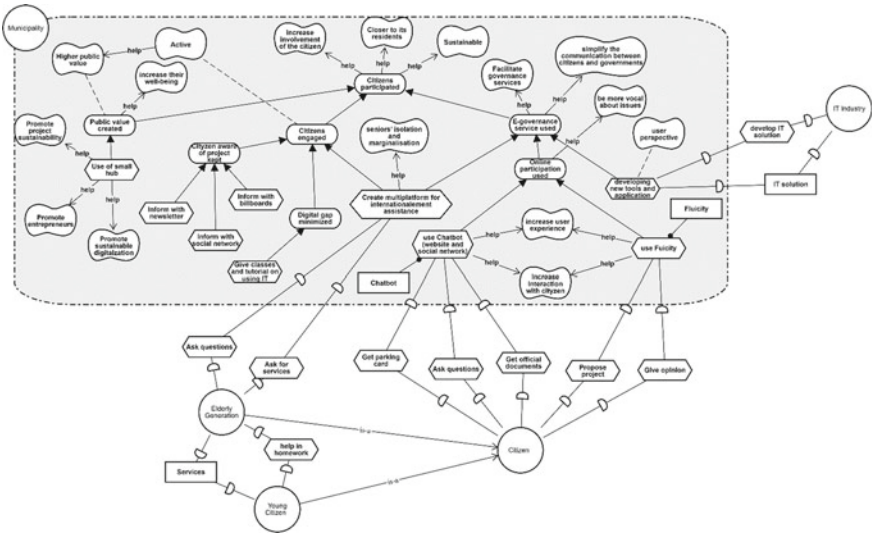

Fig. 4 Strategic Rationale diagram of citizen participations

presents the creation of a multiplatform for intergenerational assistance decomposed into more precise subtasks.

The goals that have to be reached required the dependency of citizens and the IT industry. Without the citizens, the applications would not be pertinent as they would not be used and would become obsolete. Finally, without the IT industry, it would be difficult to respond to citizens' expectations as no new technologies would be developed.

9 Collaboration in An Ecosystem

The last common interest mentioned by the interviewees is the notion of collaboration. Indeed, a lot of literature studies and scientific journals based on the concept of smart city, put emphasis on terms such as synergies, holistic approach and ecosystems. As a matter of fact, Desdemoustier et al. (2019) presented a framework to structure stakeholder relationships in a smart city. This framework is depicted as a horizontal integration referring to the capacity to combine organisations, actors, stakeholders, social groups and different interests in the governance of a city.

In Belgium, there are already some collaborative projects between the stakeholders. For instance, the third interviewee mentioned that is currently working on a project in the province of Namur, where a hub of universities, digital leaders, enterprises and start-ups can collaborate. In Brussels, even though there are many different labs (such as the one in the case municipality), there is a lack of a hub that regroups various actors of a Smart City together.

At the regional level of Brussels-Capital, the second interviewee was under the impression that the BRIC needs to work more efficiently and invest more in domains such as job creation and Open Data. An Open Data Platform would enable the public sector to make any data at their disposal available to the public. It is a demonstrated element of openness and transparency and appreciated by numerous actors from the private and public sector. In a nutshell, data processing can be very effective for the public sector and could act as a source of innovation. Meanwhile, the insights that could be provided via this medium could support any decision making process for public authorities.

Although the case municipality can be considered advanced compared to other municipalities in the region of Brussels, still the local administration is not working in an independent fashion. Indeed, it is confronted with limited budget, so economies of scale are really important when using new technologies to reduce expenses. The first interviewee (alderman) states:

> "We are currently in a connected world. Therefore, our applications or tools have to be compatible and transferable with other municipalities, with the authorities of region, the federal government or even at the level of European Community."

From the industry's perspective, the importance of collaboration is self-evident. A common mission objective is the point of convergence among municipalities, citizens and other companies. This was emphasized during the conduct of the semi-structured interviews where the sixth interviewee's role (he is currently working at an organization providing IT services) is to offer a multidisciplinary approach, involving several actors, in a situation where multiple parties are involved (i.e., municipalities, private companies, citizens, etc.). The interviewee noted that leadership is a prerequisite in the case that industries want to achieve a successful collaboration. The notion of leadership has also been mentioned in the practical guide on how to build a smart city by the Smart City Institute.

The message derived from the interview with the seventh interviewee concerned the need for the creation of an ecosystem that allows for the discovery and collaboration of companies specialized in different domains (i.e., there are companies specialised in sensors while others in communication networks, etc.). Therefore, Sibelga - as the official supplier of street lightning for the nineteen municipalities of Brussels - emphasises on a common protocol that allows for a maximum degree of interoperability among its suppliers. This particular interviewee was under the impression that this is not yet the case for the city of Brussels where it is still dependent on one supplier which might lead to precarious situations in case the relationship with this supplier may be in jeopardy.

The banking sector can also be considered as an actor in a smart city project. For instance, BNP Paribas Fortis, one of the biggest banks in Belgium, has recently launched the 'Sustainable Business Competence Centre (SBCC)' specialising in four domains: 1) Decarbonisation (withdrawal of fossil energy's use), 2) Circular Economy, 3) Human Capital and 4) smart city. SBCC aspires to provide high technological competences to its clients, create an important networking base and develop new financial services and products that would be sustainable. Accounting for the

fact that cities and municipalities play an important role in the socioeconomic development of a region, the SBCC is aiming at a close collaboration with them in the effort of creating values for the people and for the planet.

The abovementioned elements demonstrate that there are many interests interlinked with many stakeholders in the pursuit of using new technologies in order to make a more sustainable world. The fifth interviewee states:

> "…in order to reach the seventeen goals of the sustainable development goals from the UN, Belgium needs to invest sixteen billion of euros a year in the incoming years. So, budgeting is a real issue for all the stakeholders."

Finally, the fourth Interviewee has presented Agoria's objective of becoming the 'single point of access' for every city and municipality exploiting their important network of city representatives, political leaders and the technological industry. Agoria aspires to act as a facilitator for the government in setting up 'smart city' projects. For instance, they are currently helping the Flemish region to adopt a smart public lighting system; they are also working with the executive branch of the Flemish Community in launching an IoT and Artificial Intelligence dynamic hub with a lot of collaboration possibilities among different actors.

This organisation is deemed important regarding the topic of this chapter as it can be perceived as the platform to build an ecosystem for smart cities. It is aligned in fact with the quadruple helix model of Finquelievich et al. (2016) replacing the classic private and public partnership in the effort of integrating universities, industries and governments, thusly emerging as a new agent of knowledge creation which Leydesdorff and Deakin (2011) call 'the civil society'.

To conclude, a collaborative governance is necessary for a smart city as it engages stakeholders in a collective decision-making process. This collaboration is consensus-oriented, deliberative and aims to establish or implement public policies or manage public programmes or assets (Castelnovo et al., 2015). Consequently, this kind of open governance raises several issues related to a new form of management, new decision-making processes and new leader-emerging roles. It also implies coordination, interaction and co-creation among the stakeholders accounting for all sorts of different perceptions on smart cities. The challenge concerns primarily the establishment of a dynamic partnership based on true stakeholder engagement active in enhancing stakeholders' appropriation and participation.

During the interview with the third interviewee, it was mentioned that the different stakeholders in a smart city should work jointly in order to create a collaborative territory using new technologies that would be more engaging and more appealing for everyone. To achieve this objective, the first step is to inform the local authorities about the smart city-project initiatives. The challenge lies in the fact that different participants in the project may define and understand the concept of a smart city differently which may create some disparity along the way. Therefore, instead of talking about smart initiatives, third interviewee suggested that it is better to use terms such as sustainability, environment, etc. Indeed, terms as such can be more impactful and may lead to a better appreciation by the local government as they can expect real solutions for their problems on mobility, energy. Thus, improved

communication between all the different stakeholders may be the catalyst for the creation of new technologies that could help them become more efficient as well as their localities.

However, creating a synergy between different stakeholders is not an easy task. When it comes to Belgium, a specific challenge comes from its small territory with a lot of institutions and fragmented power which leads eventually to scattered initiatives. Moreover, the need to an augmented interconnectivity between available devises and other smart objects can lead to an unmanageable amount of heterogeneous technologies. As a consequence, this affects the inter collaboration between private and public actors especially if they are not synchronized in terms of information technologies. This is why it is necessary to create a unifying and integrative system.

The i* SR diagram for the stakeholders' collaboration ecosystem is depicted in Fig. 5. The analysis of this figure focuses on the top-level goal of a collaborative governance with two main actors: (1) the municipality and (2) the various industries. The two remaining stakeholders have not been depicted as they have minor roles compared to these two. The goal of collaborative governance is broken down in three tasks, namely: (1) invest in job creation, (2) product economies of scale and (3) having a common objective with the stakeholders. The municipality is dependent on various companies in order to implement their smart initiatives.

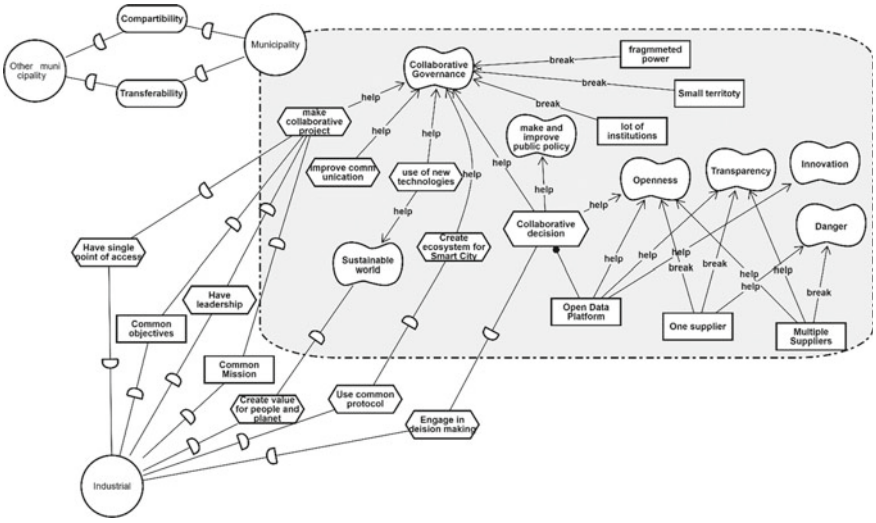

Fig. 5 Strategic Rationale diagram of stakeholders' collaboration

10 Conclusion

This chapter is meant to depict that quite often large cities are not built homogeneously with a unique central board of governance; rather, they are structured as an aggregation of different local authorities, all having various agendas and variable budgets to deal with. In turn, these local authorities have to coordinate - for the sake of completion of smart city projects - with different public or private organizations and institutions taking into consideration the best interest of their citizens. This leads to a very complex organizational setting where the needs of each individual stakeholder have to be understood explicitly for an accurate evaluation of the new, current and past projects. Belgium and Brussels in particular, can serve as an illustrative example of the abovementioned challenges due to its disintegrated form of governance, hence the relevance of our study.

Additionally, a performant smart city can be assessed through the successful technological integration of many stakeholders, helping the municipalities to improve their efficiency, increase their economic potential, open door to new businesses and services, and ultimately improve the living conditions of its citizens. The first step towards this level of technological alignment should be the explicit mapping of the strategic objectives of a smart city project. We have identified sustainable mobility, citizen participation and collective governance as the three main strategic objectives of a smart city project. Our study shows that even if these common objectives are set to drive the development of Brussels into a smart city, different (involved) stakeholders advocate different ways for their realization and prioritize different outcomes.

The use of i*-based representations is beneficial for a better identification of the abovementioned objectives while furnishing a tool for their coordination. Using the SR Model for representing stakeholders' interactions allows analyzing the forces at play in smart cities. Such a representation can thus provide relevant and insightful information when smart cities' governance and management decisions are taken. Urban decision-makers and policy-makers can take advantage of such a tool. In addition, by classifying some actors, objectives and needs of smart cities, city managers can define different tactics and technologies relevant for different groups of actors accordingly. Ultimately we aim to build a digital twin of a smart city from our i* representations to dispose of a fully automated tool for simulating the consequences of strategic, tactical and operational decisions.

References

Alawadhi, S. J., Leung, S. R., Scholl, H. A., Walker, S., Aldama-Nalda, A., Gil-Garcia, J., Pardo, T. (2012). Lecture Notes in Computer Science (including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), Vol. 7443, pp. 40–53.

Axelsson, K., & Granath, M. (2018). Stakeholders' stake and relation to smartness in smart city development: Insights from a Swedish city planning project. *Government Information Quarterly, 35*(4), 693–702.

Appio, F., Lima, M., & Paroutis, S. (2019). Understanding Smart Cities: Innovation ecosystems, technological advancements, and societal challenges. *Technological Forecasting & Social Change, 142*, 1–14.

Ben Letaifa, S. (2015). How to strategize smart cities: Revealing the SMART model. *Journal of Business Research, 68*(7), 1414–1419.

Bolívar, M. P., & Meijer, A. J. (2016). Smart governance: Using a literature review and empirical analysis to build a research model. *Social Science Computer Review, 34*(6), 673–692.

Brussels Smart City. (2020). The Brussels smart city strategy. Retrieved from https://s3.eu-west-1.amazonaws.com/expopolis-scve/Fair1/TheBrusselsSmartCitystrategy.pdf.

Caputo, F., Walletzky, L., & Štepánek, P. (2019). Towards a system thinking based view for the governance of a smart city's ecosystem. *Kybernetes, 48*(1), 108–123.

Caragliu, A., Del Bo, C. and Nijkamp, P. (2011). Smart cities in Europe. *Journal of Urban Technology, 18*(2), 65–82.

Castelnovo, W., Misuraca, G., Savoldelli, A., Bolívar, M., Meijer, A., & Gil-Garcia, J. (2016). Smart cities governance: The need for a holistic approach to assessing urban participatory policy making. *Social Science Computer Review, 34*(6), 724–739.

Dalpiaz, F., Franch, X., & Horkoff, J. (2016). IStar 2.0 Language Guide.

Da Silva, A., M. Costa, & Macedo., M (2008). Multiple views of sustainability urban mobility: The case of Brazil. *Transport Policy, 15*, 350–360.

Deschouwer, K., & Reuchamps, M. (2013). The Belgian federation at a crossroad. *Reg. Fed. Stud., 23*(3), 261–270.

Desdemoustier, J., Crutzen, N., Pichault, F., Teller, J., Giffinger, R., Ballon, P., & Smart City Institute. (2019). *Deciphering the Understandings and Appropriation of the Smart City concept: A Multilevel Inquiry*. Université de Liège, Liège, Belgique.

Fernandez-Anez, V., Fernández-Güell, J. M., & Giffinger, R. (2018). Smart City implementation and discourses: An integrated conceptual model. *The Case of Vienna. Cities, 78*, 4–16.

Finquelievich, S., Feldman, P., & Girolimo, U. (2016). Public policies for productive innovation in knowledge society. In *Proceedings of the 9th International Conference on Theory and Practice of Electronic Governance*, 01–03, pp. 109–112.

Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanovic, N., & Meijers, E. (2007). *Smart Cities—Ranking of European Medium-Sized Cities (Report)*. Vienna University of Technology. Retrieved from http://www.smart-cities.eu/download/smart_cities_final_report.pdf.

Gil-Garcia, J. R., Zhang, J., & Puron-Cid, G. (2016). Conceptualizing smartness in government: An integrative and multi-dimensional view. *Government Information Quarterly, 33*(3), 524–534.

Hammer, M., & Champy, J. (2001): *Reengineering the Corporation*. New York: HarperCollins Publishers, Inc.

Hemment, D., & Townsend, A. (2013). Here come the smart citizens. In D. Hemment, & A. Townsend (Eds.), *Smart Citizens* (Vol.4, pp. 1–3). Manchester: Future Everything Publications.

Hollands, R. (2008). Will the real smart city please stand up? *City, 12*(3), 303–320.

Kashnitsky, I., De Beer, J., & Van Wissen, L. (2020). Unequally ageing regions of Europe: Exploring the role of urbanization. *Population Studies*, 1–17.

Kolp, M., Faulkner, S., & Wautelet, Y. (2008). Social structure based designpatterns for agent-oriented software engineering. *International Journal of Intelligent Information Technologies, 4*(2), 1–23.

Kolp, M., Wautelet, Y., & Faulkner, S. (2011). Sociocentric design of multi-agent architectures. In Yu, E., Giorgini, P., Maiden, N., and Mylopoulos, J. (Eds.), *Social Modeling for Requirements Engineering*. MIT Press.

Kolp, M., & Wautelet, Y. (2015). Human organizational patterns applied to collaborative learning software systems. *Computers in Human Behavior, 51*, 742–751.

Leydesdorff, L., & Deakin, M. (2011). The triple-helix model of smart cities: A neo-evolutionary perspective. *Journal of Urban Technology, 18*(2), 53–63.

Lytras, M. D., & Visvizi, A. (2020). Information management as a dual-purpose process in the smart city: Collecting, managing and utilizing information. *International Journal of Information Management*. https://doi.org/10.1016/j.ijinfomgt.2020.102224

Lytras, M. D., Visvizi, A., Chopdar, P. K., Sarirete, A., & Alhalabi, W. (2020). Information Management in Smart Cities: Turning end users' views into multi-item scale development, validation, and policy-making recommendations. *International Journal of Information Management*. https://doi.org/10.1016/j.ijinfomgt.2020.102146

Visvizi, A., Lytras, M. D. (Eds.). (2019). Smart Cities: Issues and Challenges: Mapping Political, Social and Economic Risks and Threats, Elsevier, ISBN: 9780128166390, https://www.elsevier.com/books/smart-cities-issues-and-challenges/lytras/978-0-12-816639-0.

Visvizi, A., Lytras, M. (2018). Rescaling and refocusing smart cities research: from mega cities to smart villages. *Journal of Science and Technology Policy Management (JSTPM)*. https://doi.org/10.1108/JSTPM-02-2018-0020.

Marceau, J. (2008). Introduction: Innovation in the city and innovative cities. *Innovation: Management, Policy & Practice, 10*(2–3), 136–145.

Nam, T., & Pardo, T. (2011). Smart city as urban innovation: Focusing on management, policy, and context. In *Proceedings of the 5th International Conference on Theory and Practice of Electronic Governance*, pp 185–194.

Walravens, N. (2015). Mobile city applications for Brussels citizens: Smart City trends, challenges and a reality check. *Telematics and Informatics, 32*(2), 282–299.

Wautelet, Y. (2012). Representing, modeling and engineering a collaborative supply chain management platform. *International Journal of Information Systems and Supply Chain Management (IJISSCM), 5*(3), 1–23.

Wautelet, Y., Heng, S., Kolp, M., Penserini, L., & Poelmans, S. (2016). Designing an mooc as an agent-platform aggregating heterogeneous virtual learning environments. *Behaviour & Information Technology, 35*(11), 980–997.

Wautelet, Y., Kolp, M., Heng, S., & Poelmans, S. (2018). Developing a multi-agent platform supporting patient hospital stays following a socio-technical approach: Management and governance benefits. *Telematics and Informatics, 35*(4), 854–882.

Wautelet, Y., Kolp, M., & Penserini, L. (2018). Service-driven iterative software project management with i-tropos. *Journal Of Universal Computer Science, 24*(7), 975–1011.

Wautelet, Y. (2019). A model-driven IT governance process based on the strategic impact evaluation of services. *Journal of Systems and Software, 149*, 462–475.

Yin, R. K. (2003). *Applications of Case Study Research* (2nd ed). Thousand Oaks (Calif.): Sage.

Yu, E., Giorgini, P., Maiden, N., & Mylopoulos, J. (eds.). (2011). *Social Modeling For Requirements Engineering*. MIT Press.

Samedi Heng Ph.D., Assistant Professor, ULiège, Belgium. His research interests include Software Engineering, Agile Methods, Requirements Engineering, Multi-Agent Systems, Business Intelligence and Business (Re)engineering

Delphine Chen Master in Business Information Management, KU Leuven, Belgium. Her research interests include blockchain and automation

Konstantinos Tsilionis Ph.D. candidate, KU Leuven, Belgium. His research interests include requirements Engineering, Model-Based Systems Engineering, IT Governance

Yves Wautelet Ph.D., Professor, KU Leuven, Belgium. His research interests include lifecycle management, requirements engineering, IT governance, agent-oriented development and e-learning

Culture Powered by Blockchain in Smart Cities

Radosław Malik, Anetta Anna Janowska, and Katarzyna Ciupa

Abstract Access to cultural goods powered by blockchain is a highly valued and attractive proposition for smart city growth. It provides various benefits for three groups of stakeholders: artists/creators, consumers, and city authorities. Blockchain facilitates access to cultural goods in smart cities with: (i) improved copyright control; (ii) reduced transaction costs; (iii) provision of reliable information, and (iv) new possibilities for funding of cultural goods by the public. Access to cultural goods powered by blockchain influences smart city growth with: (i) creative businesses development; (ii) a positive impact on other industries, e.g. tourism and ICT; (iii) creative buzz attracting creative workers and investors; (iv) higher public and private culture expenditure, (v) improved global accessibility of locally created cultural goods, and (vi) augmented participation in culture. Thus, access to cultural goods powered by blockchain in a smart city is beneficial to city inhabitants' well-being and city livability.

Keywords Culture · Cultural goods · Smart city · Blockchain · Stakeholders · Creative business · Access

1 Introduction

Literature and practice relating to the concept of a smart city focus on the innovative application of information and communication technology (ICT), including the internet of things (IoT), sensors, big data and other in the city space (Camero & Alba, 2019; Harrison et al., 2010; Lee et al., 2013; Visvizi et al., 2017; Lytras et al., 2021). These are recognized as remedies for shortcomings of increased urbanization (Malik & Janowska, 2018). Moreover, these technology developments are increasingly recognized as leverage of the city's livability and city inhabitants' well-being (Batty et al., 2012; Dameri, 2013; Giffinger & Pichler-Milanovic, 2007; Lytras et al., 2020; Shelton et al., 2015). Recently, scholars and urban policy practitioners have

R. Malik (✉) · A. A. Janowska · K. Ciupa
SGH Warsaw School of Economics, al. Niepodległości 162, 02-554 Warsaw, Poland
e-mail: rmalik@sgh.waw.pl

A. Visvizi and O. Troisi (eds.), *Managing Smart Cities*,
https://doi.org/10.1007/978-3-030-93585-6_13

underlined the role of culture as a cornerstone for creative and smart city development (Comunian, 2011; Garau, 2014; Garcia, 2004; Landry, 2012; Lee et al., 2013; Piccialli & Chianese, 2018; Pratt, 2010), as well as urban regeneration (Ashton, 2018; Della Lucia et al., 2017; Dinardi, 2015; Pratt, 2009; Sasaki, 2010; Shin & Stevens, 2013; UNESCO, 2016). It is highlighted that not until the synergies between culture and technology in urban areas are fully exploited can the development of human potential reach its pinnacle (Albino et al., 2015). Thus, cultural and historical city profiles have been recently recognized as crucial avenues for expanding smart city research (Allam & Newman, 2018). However, creating, distributing, promoting and accessing cultural goods, especially in digital form, is a very complex process posing additional challenges (O'Dwyer, 2020). Therefore, a novel technological approach to unlock the potential of cultural goods for smart city development is required.

Blockchain constitutes an attractive value proposition for supporting cultural goods management (Whitaker, 2018), (McConaghy et al., 2017; O'Dwyer, 2020; Tapscott & Tapscott, 2018). New applications of this general technology are being developed (Lotti, 2016), and its impact on public policies is being reviewed (Sicilia & Visvizi, 2019). Blockchain provides a decentralized and transparent structure which is viewed as an efficient solution for identification, authentication and payment for digital culture (McConaghy et al., 2017). However, the blockchain applications for access to cultural goods have not been discussed in detail in the context of smart city development thus far, and this creates the rationale for this research.

The research uses an integrative literature review and stakeholder conceptual approach to critical analysis of the existing body of knowledge related to the connection between three broad research streams, namely culture, blockchain and smart cities, to address the following research questions:

Q1: How does blockchain facilitate access to culture?

Q2: How does access to culture powered by blockchain facilitate smart city development?

The remainder of this chapter is structured as follows. The research methodology is described in Sect. 2. The conceptual background in two crucial dimensions, i.e. the connection between culture and the smart city, and between blockchain and culture, are discussed in Sect. 3. In Sect. 4, the shareholder approach is applied to discuss the benefits of improved access to culture powered by blockchain in the smart city. Section 5 provides a summary of the key findings and recommendations for further studies.

2 Methodology

This paper conducts an integrative literature review and uses the stakeholder conceptual approach. The purpose of the integrative literature review is to review and conceptualize the connection between the smart city, culture and blockchain. The purpose of the stakeholder conceptual approach is to identify groups of stakeholders in line

with their interests and benefits in adopting the blockchain technology for cultural goods access in a smart city, and thus recognize avenues for smart city development.

An integrative review aims to assess, critique, and synthesize the literature on a research topic in a way that enables new theoretical frameworks and perspectives to emerge (Torraco, 2005). Integrative literature reviews may be used to address emerging topics to create initial conceptualizations and theoretical models or propose research agenda, and their purpose is usually not to cover all articles ever published on the topic, but rather to combine perspectives and insights from different fields or research traditions (Snyder, 2019). Using the general guidelines on literature reviews to ensure academic rigor in documenting the literature research process (Brocke et al., 2009), we seek to define the review scope, conceptualize the topic, perform a literature search, analyze and synthesize the relevant literature, and propose a new research agenda. In the literature search, the Web of Science database was probed for articles, conference proceedings and other documents with a combination of various forms of the terms "smart city", "blockchain", "culture". The synthesis of the relevant literature on the connection between a smart city and culture and between blockchain and culture is presented as the theoretical background (Sect. 3) as well as the outline of a new research agenda (Sect. 5).

The stakeholder analysis used as the conceptual approach adopted in this research is a quick and useful way to identify stakeholders and clarify their interest (Bryson, 2004) The stakeholder analysis has been used to analyze projects in smart cities (Paskaleva et al., 2015). Analyzing stakeholders at its core is a process of identifying and categorizing them (Freeman, 2010). The validity of the entire stakeholder analysis relies on stakeholder identification as the first step in the process (Fritz et al., 2018). There are several methods to support stakeholder identification (Reed et al., 2009). Two common ones, brainstorming and context-specific stakeholder lists (Fritz et al., 2018), were utilized in the study to provide a stakeholder conceptual approach of access to cultural goods in a smart city enabled by blockchain (Sect. 4).

3 The Conceptual Background

The initial literature search with WoS, with a combination of three terms, smart city, culture, and blockchain, returned just one article with limited application to the research area. The lack of research papers showed that this was a new area of research, and this indicated that the literature review needed to be divided into two separate research streams along the culture-smart cities and blockchain-culture research axis instead of one triangular combination of culture-blockchain-smart cities. This approach, combined with the insight from established reference texts on cultural economics and the otherwise rich body of blockchain literature, provides the groundwork for a subsequent discussion in Sect. 4.

3.1 Culture and Smart City

The importance of culture lies in its ability to manage creativity and knowledge as well as influence economic, social and cultural change (Hesmondhalgh, 2013). Moreover, culture supports competitiveness and economic growth, and leverage of sustainable development (UNESCO, 2013), and constitutes a crucial aspect of innovation (Han & Hawken, 2018). However, cultural goods yield cultural value apart from their economic or commercial value (Dekker, 2015; O'Brien, 2014), thereby contributing to a community understanding of cultural identity (Throsby, 2010). They produce engaged citizens by shaping reflective individuals and support healthier and more balanced communities due to social inclusion (Crossick and Kaszycka, 2014).

Consequently, culture impacts city development on both a social and an economic level by stimulating and protecting the interests of all the stakeholders, namely artists/creators, consumers (both individual and business) and, finally, the city authorities responsible for implementing urban development strategies. The social dimension is reflected in higher cultural participation due to the improved access to culture. Moreover, culture adds vibrancy to urban life (Neirotti et al., 2014) and augments livability of the cities (Newman, 1999; UNESCO, 2013; Visvizi & Lytras, 2020). Culture leads to greater tolerance (Florida, 2002, 2005) and accelerates inclusiveness of people, including newcomers.

As for the economic advantages, the cultural and creative sectors (CCS) often concentrated in urban areas generate substantial revenues and create a considerable number of jobs worldwide. Creative sector revenues were estimated at US$ 2 trillion and the number of jobs to be 29.5 million in 2013 (EY, 2015). However, according to a different calculation by UNCTAD, the global market for creative goods was US$ 509 billion in 2015 (UNCTAD, 2018). Serving as urban hubs for creativity and innovativeness, CCS foster entrepreneurial endeavors (Hesmondhalgh & Baker, 2013) and stimulate expansion of dynamic creative processes (Corazza, 2016; Janowska, 2017), which influence other sectors in cities, i.e. it attracts investment and tourism.

Cultural goods, also referred to as cultural works, constitute the output of the cultural and creative sectors. They are defined as products of human activity, involving a form of creativity in their production, and generating and communicating the symbolic meaning and embodying some form of intellectual property (Throsby, 1998). They comprise a variety of items such as paintings, crafts, design works, musical works, films, books, theatrical performances, photographic works, video games etc. (DCMS, 1998; Hesmondhalgh, 2013; Throsby, 2008). However, as the idea of the smart city is strongly anchored in ICT, the analysis of the role of culture in smart city development focuses mainly on cultural goods (Curien & Moreau, 2010; Towse & Handke, 2013), such as music, films, books, photographic works and video games in their digital, intangible versions, as well as on digital distribution and digital access to them.

As some cultural goods are public goods (Bakhshi et al., 2015; Belleflamme & Peitz, 2012), cultural goods, developed in smart cities, are laborious and expensive to

produce (for example due to high sunk costs), and effortless and inexpensive to reproduce (Handke, 2013), especially in digital form. The solution protecting them from market failure is copyright (Wang, 2016) which ensures that artists are remunerated for their work and consequently are incentivized to create. Digitization has undermined this cultural goods production system (Liebowitz, 2013) and therefore various methods have been applied to remedy the situation such as strengthened copyright and technological solutions to limit their usage (O'Dwyer, 2020) e.g. digital rights management (DRM) systems (Dhingra, 2017).

Nevertheless, these measures adopted to protect the cultural good production system are proving to be ill-suited for the digital distribution and access to cultural goods for several reasons. Firstly, they failed to stop unauthorized sharing of cultural goods by consumers, leading to reduced revenue for artists (producers). Secondly, they increased the transaction costs, which can hardly be borne by individual artists or small companies, and hindered re-use, adaptation, and other creative activities based on existing cultural goods, on which culture has been built for centuries. Thirdly, the abundance of cultural content accessible on the Internet has also confused consumers about legality of its usage, whereas lawsuits brought against users by copyright holders, mainly large multinational companies, have led to conflicts between artists and their public (Tapscott & Tapscott, 2018, p. 242).

The structure of cultural and creative sectors concentrated in cities is very complex, with a substantial number of intermediaries between the artists and the public, namely producers, publishers, cultural institutions, and distributors of the cultural goods, including digital distribution. This complexity makes transaction processes complicated and inefficient, and the whole system unsustainable, undermining the artist's role as a cultural goods producer and enabling intermediaries to capture an important portion of the value of the cultural goods (Benghozi and Paris, 2014). However, as smart cities are often described as systems that "sense and act" (Neirotti et al., 2014), ICT solutions, and especially blockchain, could also be used to help digital culture thriving to the benefit of the city and its citizens—both creators and users.

3.2 Blockchain and Culture

Since it was first applied in the bitcoin use case, blockchain technology has gained increasing attention from both individual as well institutional actors (Lotti, 2016). The possibility of creating, recording and transacting anything of value in a decentralized, distributed and transparent manner, and thus the ability to introduce a form of scarcity in the digital realm, has already proven to be appealing in areas such as trade, finance, supply chain management and logistics. Consequently, blockchain characteristics started to be recognized as valuable in many other, less obvious, areas such as culture (O'Dwyer, 2020), and their potential to transform creative activities has been increasingly recognized (Whitaker et al., 2020).

To assess the blockchain value proposition for culture in smart cities and determine its potential, blockchain's characteristic features need to be examined in the context

of culture (O'Dwyer, 2020). Blockchain decentralization and distribution ensures that there is no central database that could be considered as a single point of failure, while the whole structure consists of identical copies that are stored by distributed entities, therefore creating valuable opportunities for the facilitation of digital records (Monrat, Schelén & Andersson, 2019). This feature is critical for cultural goods management as it provides better protection of cultural goods against malicious interference and facilitates access to digital culture (Ch'ng, 2019).

Synchronization, another important characteristic of blockchain, reinforces its potential for application to culture. Blockchain is organizationally decentralized but also logically centralized as it means that there is one set of rules and one logic followed by all stakeholders. All distributed copies of the database provide users with the most recent status of all actions, and thus all of them can be used to track and trace access management of cultural goods. This can be viewed as a critical application for enforcing intellectual property rights in art management (Zeilinger, 2018).

Due to transparency, another important feature of blockchain, a record of all actions can be made visible to stakeholders so that they can audit the whole process. As a result, blockchain provides a decentralized, synchronized and transparent structure in which participants can register, store, and exchange representatives of anything of value, according to one set of rules. Blockchain, therefore, is the very first solution to the 'double-spending problem (O'Dwyer, 2015) that enables value exchange (or exchange of blockchain representation of anything of value) without the need for a middleman, which is viewed as an important feature for cultural and creative sectors (O'Dwyer, 2020).

Blockchain also enables a very cost- and time efficient exchange of such value representatives and therefore could considerably improve the management of cultural goods, especially with regard to transactions and payments (Xu, Chen & Kou, 2019). This is because once the exchange has been performed using value representatives, its execution, clearing, settlement and ex-post transaction management can be done using smart contracts. These are blockchain-based programs that are self-activated once the predefined conditions are met, and thus they can vastly automate the exchange of digital culture, making the whole process free from third-party middlemen (Frizzo-Barker et al., 2020).

Blockchain is also considered a secure database due to other characteristics. The blockchain structure (according to the initial concept) is append-only and tamper-proof, which both imply that it is not possible to change past inputs without great expense and without this being noticed by another players (Warkentin & Orgeron, 2020). Such a feature makes the whole database resistant to unwanted or manipulatory changes, and thus sheds light on the management of cultural goods in a digital realm.

Over the last few years, blockchain technology has evolved considerably, and currently there are many different blockchain propositions available. As a result, the number of potential areas in which blockchain could solve existing inefficiencies has been growing, and new propositions could, as suggested above, also include cultural and creative sectors (De Filippi, 2016; Lee, 2018; Lotti, 2016). Regarding

these sectors, blockchain, with its attractive value proposition, has been considered a potential solution for identification, authentication and payment for digital culture as well as its sustainable usage (McConaghy et al., 2017).

4 Discussion. Access to Cultural Goods Powered by Blockchain in Smart Cities

Access to cultural goods powered by blockchain forms a link between culture and technology in the smart city context. The improved access to cultural goods relates to various aspects of their circulation on the internet, such as due management of supply, fair usage, and more effective transaction processes. Access to cultural goods powered by blockchain in a smart city could be considered from the perspective of the stakeholders' expectations, goals and benefits.

Based on the context-specific list of stakeholders' approaches and outcomes of brain-storming analysis, three distinctive stakeholder groups have been identified, which are artists/creators, consumers and city authorities. Thus, the stakeholder conceptual approach taken in this research enables a multi-perspective insight into access to cultural goods powered by blockchain as identified stakeholders represent supply (artists/creators), demand (consumers) and institutional order (city authorities) perspectives.

4.1 Artists/Creators

Artists/creators, and producers of cultural goods (e.g. publishers, video game studios) represent the supply side of the cultural goods exchange process. Their main goals and expectations towards digital distribution and access for consumers lie in enhanced cultural works management possibilities resulting in reputation (brand) building and more efficient monetization. Moreover, they include the possibility of eliminating intermediaries from the value chain, which simplifies the exchange and decreases transaction costs (Tapscott & Tapscott, 2018).

Access to cultural goods powered by blockchain in a smart city addresses expectations of that group of stakeholders in various ways.

Due to smart contract control over digital copies (Pons, 2017), the artists/creators or the copyright holders (e.g. producers of the cultural work) define the legal permissions of the works they disseminate online, based on the system of Creative Commons licenses (CC). This creates an opportunity to divide their public into diverse segments and develop diversified business strategies with reference to the respective consumer groups.

Moreover, improved access to cultural goods powered by blockchain relies on the ability of smart contracts to combine relative simplicity of the contractual terms with

instant receipt of the due fee by the licensor thanks to automatic license payment. Thus, artists/creators monetize their work as soon as it is commercially used. Specific rules of usage and payment are then specified in the smart contract. This solution addresses the problem of fair compensation for every member of the creative process. Payment to designated parties may be not only instantaneous, but also carried out as micropayments even for snippets of the work. Moreover, as a cryptotoken is assigned to the cultural good or to a part of it, the whole payment process may be completed beyond the traditional financial system.

The next benefit of blockchain application for cultural goods access for artists/creators lies in the artists/creators' ability to develop closer relationships with the end-users of the cultural works. An artist/creator may allow consumers to access cultural goods free of charge. Promoting the artist's/creator's works through such measures is viewed as crucial in the digital environment, in which there is an excessive supply of cultural goods of varying quality, and a relative deficit of public attention (Citton, 2014). Artists may then use their free (gratis) digital works as promotion of artistic events, e.g. live performances, limited product versions, special artistic events. Alternatively, cryptotokens may be used to forge a bond with the audience by rewarding them for various online activities. Cryptotokens may also be sold to the public in order to raise funds to finance artistic projects (De Filippi, 2015). A vivid illustration of effective usage of this feature is provided by the dance artist Gramatik, who created his own cryptotoken to fund artistic projects. The scheme groundwork encompasses the artist's shares in royalties to be distributed to fans based on cryptotoken ownership (Etherscan. Token Gramatik).

The possibility of tracking all cultural goods due to the blockchain features provides artists/producers (copyright holders) with an impressive amount of data about users and transactions. Data analytics may also be applied to observe users' habits and preferences, and, consequently, to plan future projects and to attract the right merchandisers and distributors (Stankovic, 2019). Likewise, since blockchain may help to link a reputation with specific hashes, it can be used by artists to certify the authenticity of works and assess artists' credibility, as well as that of their prospective partners.

Using the smart contract feature provided by blockchain also means that intermediaries such as copyright collecting societies, as well as private copyright firms (e.g. music publishing companies) can be eliminated from the cultural goods value chain. This gives artists/creators the opportunity to maximize their value.

The Ujomusic.com platform, based on the Ethereum blockchain, provides an illustration of benefits of improved access to cultural goods powered by blockchain described above. Ujomusic's value proposition is "connecting fans and artist directly" and thus it addresses the interests of the artist/creator stakeholder group. Thanks to this application, artists/creators are equipped with a solution that allows direct transactions with consumers, thus bypassing intermediaries, and maximizing their value.

4.2 Consumers

Perceived as the major beneficiaries of digitization, consumers constitute nonetheless a heterogenous group with diverse interests. Consumers accessing cultural goods seek maximum utility. However, due to the specific character of these goods, referred to as experience goods (Nelson, 1970), as well as to oversupply resulting in the paradox of choice (Schwartz, 2014), they require reliable information about cultural goods. Such information requirements also apply to legal permissions (information about licenses) for possible usages that enable compliance with copyright laws or for which the motivation might be respect for the artists/creators.

Access to cultural goods powered by blockchain provides consumers with information about a product's authenticity and legality of distribution. Such information eliminates the risk borne by consumers that they might violate copyright rules. Moreover, a smart contract accompanying cultural goods allows consumers to decide how cultural goods are consumed (for example downloading, streaming, re-using). In the long term, this facilitates increased consumption of cultural goods (Castiglione & Infante, 2016) and develops consumers' cultural capital (Bourdieu, 1986).

The cultural goods disintermediation process (Pessach, 2013) allowed by access powered by blockchain facilitates more direct contact of consumers with artists/creators, which is considered of major value especially in the experience economy (Andersson & Andersson, 2006). The opportunity to deal directly with the artist/creator may benefit the consumer not only emotionally, but also economically. Access to cultural goods enabled by blockchain increases consumer choice, enabling maximization of their utility. The broader choice applies to various versions of the product (whether or not a fee is charged) and diverse purchase methods (within business models proposed by the artist). Moreover, consumers can opt to participate in the creation process by co-funding an artistic project. Investing in cultural goods production using cryptotokens creates an opportunity for consumers to participate in subsequent revenues.

The specific segment of cultural goods consumers is referred to as 're-users'. Re-users use existing works in production of their own cultural goods (for example video game creators who incorporate music by other artists into their own works). Their interests focus on information clarity about cultural goods licenses and an efficient payment method. Moreover, it is in their best interest to eliminate as many intermediaries as possible from the value chain to reduce the transaction costs (Hirsch and Gruber, 2015).

Blockchain facilitates improved access to cultural goods through their tracking feature. This allows re-users of cultural content to acquire reliable information about the legal permissions concerning the work. Due to the smart contract accompanying the cultural product, users may be divided into segments with specific permissions being assigned to each group, which allow product differentiation strategies. Thus, individual creators or small creative companies may be granted privileged re-use rights. As a consequence, amateur or smart scale creativity can thrive, stimulating bottom-up innovativeness in a smart city.

The example mentioned above, namely the Ujomusic platform, offers an attractive value proposition not only for artists/producers but also for consumers. The second group of stakeholders, thanks to Ujomusic, can purchase music directly from artists, which has vastly improved the transaction process, decreasing both the length and cost of the process. Consumers are also assured that the piece of work they buy is original and purchased legally.

4.3 City Authorities

The main goal of the city authorities, being the third group of stakeholders, is to build the city brand (Donner & Fort, 2018) and make the smart city thrive on a social as well as an economic level. By supporting cultural and creative production, they boost creative and innovative processes (Bakhshi et al., 2015). As a result, new business development is reinforced and competitiveness of existing ventures is increased, especially in cultural and creative sectors and tourism (Franklin, 2016). Similarly, by assisting consumers in accessing cultural goods, the authorities promote participation in culture, which results in a series of positive externalities, such as people's wellbeing (Virolainen, 2016), social inclusion (Martorana et al., 2017), social cohesion in the community, and sustainable development (Throsby, 2010). By supporting access to cultural goods using blockchain, city authorities contribute to the realization of these goals in a smart city.

The direct benefits of the improved access to cultural goods using blockchain for city authorities are twofold. Firstly, there is a positive effect on creativity and innovativeness of a smart city, as artists/creators benefit to a larger extent from cultural goods they produce, and this is a major incentive to create. Secondly, consumption of cultural goods creates an incentive for consumers to participate more in culture. This impacts not only the cultural and creative atmosphere in a smart city, but also creates positive externalities.

Moreover, consumers are encouraged to fund diverse cultural activities in a smart city with blockchain power access facilitated by the use of cryptotokens, and thus contribute to funding of culture. This increases overall public and private culture expenditure. Apart from that, with the improved access to cultural goods powered by blockchain, smart city authorities are offered the opportunity to include the cultural and creative dimension of urban development in their strategies. Thus, they can benefit from the boost to the city's attractiveness for creative workers, tourists, and investors.

Assessing the example of the Ujomusic platform from the perspective of smart city authorities, this is an attractive value proposition for this stakeholder group. Being able to provide self-created pieces of music directly via an online platform, artists/creators are no longer motivated to move to cities perceived as centers for the music industry but are able to create and provide their products from their current location. The platform thus equalizes the attractiveness of cities and offers

a chance for smaller, but smarter cities to attract well-known artists, and thus boost the popularity of the city itself.

Thus, blockchain features have substantial potential for solving problems related to cultural goods access by supporting artists/creators to better manage access to their digitized works, consumers to access them and live a more intense cultural and social experience, and the smart city's authorities to plan and implement the urban development strategies based on improved cultural and social capital.

5 Key Findings, Conclusion and Recommendations

Culture can contribute to smart city development by bringing social and economic benefits. Moreover, blockchain has considerable potential to improve access to cultural goods. The benefits of blockchain for cultural goods access in a smart city bring substantial and diverse benefits for three stakeholder groups, which are artists/creators, consumers, and city authorities.

In the response to the first research question, we have identified four solutions brought about by blockchain, highlighting its suitability to facilitate access to cultural goods in smart cities. These are: (i) copyright control over cultural goods access supporting the authors (or copyright holders) to monetize their usage; (ii) decreasing transaction costs for accessing cultural goods through disintermediation of cultural value chains; (iii) more reliable information for consumers about the cultural goods, which increases consumer use, and utility, and (iv) new possibilities for funding of cultural goods by the public.

Likewise, a series of benefits, both economic and non-economic, for city development owing to the improved access to cultural goods powered by blockchain, have been identified as the answer to the second research question. These are: (i) development of creative businesses in a smart city based on innovative technological solutions, leading to job creation and an increase in GDP; (ii) a beneficial impact on other industries, such as tourism and ICT; (iii) creative buzz based on technological innovations impacting the image of the city as smart, which can attract creative workers and investors; (iv) increased public and private expenditure on culture; (v) global accessibility and promotion of locally created cultural goods, and (vi) improved access to digitized culture, which augments cultural participation and in the long term increases the general wellbeing of city inhabitants and city livability.

Our chapter is a response to much-needed research at the point of convergence of culture and a smart city as well as blockchain use in smart city research (Visvizi et al., 2018). We have shown that blockchain has characteristics that are appealing for provision of cultural goods in terms of access plausibly provided via blockchain technology. Moreover, our chapter indicates that these applications are feasible for use in a smart city and identifies their primary advantages. Therefore, our study provides an initial insight into application of blockchain to facilitate access to cultural goods in smart cities.

Another contribution made by our research is use of a stakeholder conceptual approach for analysis for blockchain use in cultural goods in a smart city. This may be considered a launchpad for more in-depth empirical research on stakeholder perception of blockchain application for provision of cultural goods in smart cities. Once the conceptual foundations of that novel research area have been established, case study analyses of material implementations of blockchain solutions for cultural goods in the smart city environment could be considered to advance the research.

Despite all the benefits and unprecedented opportunities blockchain provides for artists and their public, there are several reservations concerning this cutting-edge technology (Stankovic, 2019), which may be addressed by future research. The issues that may affect cultural goods include but are not limited to: adequate storage of creative content, emergence of new intermediaries, legal and regulatory issues such as the national copyright models concerned, interoperability between old and new systems, errors in smart contracts and their consequences for the transactions, and trust in private blockchain ledgers. Each of these issues is a potential obstacle for further application of blockchain to improved access for cultural goods in a smart city and these could be examined in future research. In the course of our research, other less evident but legitimate avenues for further studies have been identified. Those related to culture management practices in smart cities would be particularly interesting. However, new business models empowered by blockchain open an equally interesting research avenue that would allow exploring how economic value is created, and distributed in smart cities.

Acknowledgements Research reported in this chapter has been conducted in partial implementation of the National Science Center, Poland, Grant Number 2020/39/B/HS4/00579, titled: Smart cities: Modelling, Indexing and Querying Smart City Competitiveness.

References

Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart cities: Definitions, dimensions, performance, and initiatives. *Journal of Urban Technology, 22*(1), 3–21. https://doi.org/10.1080/10630732.2014.942092

Allam, Z., & Newman, P. (2018). Redefining the smart city: Culture, metabolism and governance. *Smart Cities, 1*(1), 4–25. https://doi.org/10.3390/smartcities1010002

Andersson, Å. E., & Andersson, D. E. (2006). *The Economics of Experiences, the Arts and Entertainment*. Cheltenham: Edward Elgar.

Ashton, D. (2018). Railway arches, entrepreneurs, and culture-led urban regeneration. *Cultural Industry Research, 17*(2), 244–252.

Bakhshi, H., Cunningham, S., & Mateos-Garcia, J. (2015). Public policy for the creative industries. In C. Jones, M. Lorenzen & J. Sapsed (Eds.), *The Oxford Handbook of Creative Industries.* Oxford: Oxford University Press.

Batty, M., Axhausen, K., Giannotti, F., Pozdnoukhov, A., Bazzani, A., Wachowicz, M., Ouzounis, G., & Portugali, Y. (2012). Smart cities of the future. *The European Physical Journal Special Topics, 214*(1), 481–518. https://doi.org/10.1140/epjst/e2012-01703-3

Belleflamme, P., & Peitz, M. (2012). Digital piracy: Theory. In M. Peitz, & J. Waldfogel, J. (Eds.), *The Oxford Handbook of the Digital Economy*. Oxford: Oxford University Press.
Bourdieu, P. (1986). The forms of capital. In J. Richardson (Ed.), *Handbook of Theory and Research for the Sociology of Education.* Nowy Jork: Greenwood, pp. 241–258.
Brocke, J. V., Simons, A., Niehaves, B., Niehaves, B., Reimer, K., Plattfaut, R., & Cleven, A. (2009). Reconstructing the giant: On the importance of rigour in documenting the literature search process. In *European Conference on Information Systems (ECIS).* Retrieved December 8, 2020, from https://aisel.aisnet.org/cgi/viewcontent.cgi?article=1145&context=ecis2009.
Bryson, J. M. (2004). What to do when stakeholders matter. *Public Management Review, 6*(1), 21–53.
Camero, A., & Alba, E. (2019). Smart City and information technology: A review. *Cities, 93*(4), 84–94. https://doi.org/10.1016/j.cities.2019.04.014
Castiglione, C., & Infante, D. (2016). Rational addiction and cultural goods: The case of the Italian theatregoer. *Journal of Cultural Economics, 40*(2), 163–190.
Ch'ng, E. (2019). The first original copy and the role of blockchain in the reproduction of cultural heritage. *Presence: Teleoperators and Virtual Environments, 27*(1), 151–162. https://doi.org/10.1162/PRES_a_00313.
Citton, Y. (2014). *Pour une écologie de l'attention*. Paris: Le Seuil.
Comunian, R. (2011). Rethinking the creative city. *Urban Studies, 48*(6), 1157–1179. https://doi.org/10.1177/0042098010370626
Corazza, G. E. (2016). Potential originality and effectiveness: The dynamic definition of creativity. *Creativity Research Journal, 28*(3), 258–267.
Crossick, G., & Kaszynska, P. (2014). Under construction: Towards a framework for cultural value. *Cultural Trends, 23*(2), 120–131.
Curien, N., & Moreau, F. (2010). *L'industrie du disque*. Paris: La Découverte.
Dameri, R. P. (2013). Searching for smart city definition: A comprehensive proposal. *International Journal of CUmputers & Technology, 11*(5), 2544–2551.
De Filippi, P. (2015). Blockchain-based Crowdfunding: what impact on artistic production and art consumption? *Observatório Itaú Cultural*, 19. Retrieved December 8, 2020, from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2725373.
Dekker, E. (2015). Two approaches to study the value of art and culture, and the emergence of a third. *Journal of CUltural Economics, 39*(4), 309–326.
Della Lucia, M., Trunfio, M., & Go, F. M. (2017). Heritage and urban regeneration: Towards creative tourism, In: *Tourism in the City*. Springer, pp. 179–191.
Dhingra, M. (2017). Digital rights management & its consumer concerns. *International Journal of Engineering Research & Technology, 6*(3), 438–441.
Dinardi, C. (2015). Unsettling the role of culture as panacea: The politics of culture-led urban regeneration in Buenos Aires. *City, Culture and Society, 6*(2), 9–18.
Donner, M., & Fort, F. (2018). Stakeholder value-based place brand building. *Journal of Product & Brand Management, 27*(7), 807–818.
Etherscan, T. G. (no date). Etherscan: Etherscan. Retrieved December 14, 2020, from https://etherscan.io/token/0x1db42ceba6bdebf86d287e11b159ff97b083b8af.
EY. (2015). *Cultural Times: The First Global Map of Cultural and Creative Industries.* Retrieved December 8, 2020, from https://en.unesco.org/creativity/sites/creativity/files/cultural_times._the_first_global_map_of_cultural_and_creative_industries.pdf.
Florida, R. L. (2002). *The Rise of the Creative Class: And how It's Transforming Work, Leisure, Community and Everyday Life*. New York: Basic Books.
Florida, R. L. (2005). Cities and the creative class. New York: Psychology Press.
Franklin, A. (2016). Journeys to the Guggenheim Museum Bilbao: Towards a revised Bilbao effect. *Annals of Tourism Research, 59*, 79–92.
Freeman, R. (2010). *Strategic management: A stakeholder approach.* Cambrigde: Cambridge University Press.

Fritz, M. M. C., et al. (2018). A supply chain perspective of stakeholder identification as a tool for responsible policy and decision-making. *Environmental Science and Policy, 81*, 63–76. https://doi.org/10.1016/j.envsci.2017.12.011

Frizzo-Barker, J., Chow-White, P. A., Adams, P. R., Mentanko, J., Ha, D., & Green, S. (2020). Blockchain as a disruptive technology for business: A systematic review. *International Journal of Information Management, 51*, 102029. https://doi.org/10.1016/j.ijinfomgt.2019.10.014

Garau, C. (2014). Smart paths for advanced management of cultural heritage. *Regional Studies, 1*(1), 286–293. https://doi.org/10.1080/21681376.2014.973439

Garcia, B. (2004). Cultural policy and urban regeneration in Western European cities: Lessons from experience prospects for the future. *Local Economy, 19*(4), 312–326.

Giffinger, R., & Pichler-Milanovic, N. (2007). *Smart Cities : Ranking of European Medium-Sized Cities*. Vienna: Centre of Regional Science, Vienna University of Technology.

Han, H., & Hawken, S. (2018). Introduction: Innovation and identity in next-generation smart cities. *City, Culture and Society, 12*, 1–4. https://doi.org/10.1016/j.ccs.2017.12.003

Handke, C. (2013). Empirical evidence on copyright. In: R. Towse, and C. Handke, ed., *Handbook on the Digital Creative Economy*, Cheltenham: Edward Elgar Publishing.

Harrison, C., Eckman, B., Hamilton, R., Hartswick, P., Kalagnanam, J., Paraszczak, J., & Williams, P. (2010). Foundations for smarter cities. *IBM Journal of Research and Development, 54*, 1–16.

Hesmondhalgh, D. (2013). *The Cultural Industries* (3 edn.). Los Ángeles, London, New Delhi, Singapore, Washington: SAGE.

Hesmondhalgh, D., & Baker, S. (2013). *Creative Labour: Media Work in Three Cultural Industries*. Abingdon, Oxon: Routledge.

Hirsch, P. M., & Gruber, D. A. (2015). Digitizing Fads and Fashions. Disintermediation and Glocalized Markets in Creative Industries. In C. Jones, M. Lorenzen, & J. Sapsed (ed.), *The Oxford Handbook of Creative Industries*. Oxford: Oxford University Press.

Janowska, A. A. (2017). 'L'industrie du disque et sa chaîne de valeur après le virage numérique—quels défis pour la créativité des artistes ?' *Questionner le tournant créatif : dispositifs, processus et représentations* Varna: ICCA LabSic, Université Paris 13.

Landry, C. (2012). *The Creative City: a Toolkit for Urban Innovators*. Hoboken: Taylor and Francis.

Lee, E. M. (2018). A proposal on blockchain-based artwork trading system for popularization of fine art. *Journal of the Korea Convergence Society*, *9*(10), 209–215. https://doi.org/10.15207/JKCS.2018.9.10.209.

Lee, J. H., Phaal, R., & Lee, S. H. (2013). An integrated service-device-technology roadmap for smart city development. *Technological Forecasting and Social Change, 80*(2), 286–306. https://doi.org/10.1016/j.techfore.2012.09.020

Liebowitz, S. (2013). Internet piracy: The estimated impact on sales. In: R. Towse, & C. Handke (Eds.), *Handbook on the Digital Creative Economy*. Cheltenham, Northampton: Edward Elgar.

Lotti, L. (2016). Contemporary art, capitalization and the blockchain: On the autonomy and automation of arts value. *Finance and Society, 2*(2), 96–110. https://doi.org/10.2218/finsoc.v2i2.1724

Lytras, M. D., Visvizi, A., Chopdar, P. K., Sarirete, A., & Alhalabi, W. (2021). Information management in smart cities: Turning end users' views into multi-item scale development, validation, and policy-making recommendations. *International Journal of Information Management*, 56, (early cite). https://doi.org/10.1016/j.ijinfomgt.2020.102146.

Malik, R., & Janowska, A. A. (2018). Megatrends and their use in economic analyses of contemporary challenges in the world economy, *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu,* 523, pp. 209–220. https://doi.org/10.15611/pn.2018.523.18.

Martorana, M. F., Mazza, I., & Monaco, L. (2017). Participation in the arts and social inclusion in disadvantaged neighbourhoods. In V. M. Ateca-Amestoy, V. Ginsburgh, I. Mazza, J. O'Hagan, & J. Prieto-Rodriguez (Eds.), *Enhancing Participation in the Arts in the EU: Challenges and Methods* (pp. 79–95). Springer International Publishing.

McConaghy, M., McMullen, G., Parry, G., McConaghy, T., & Holtzman, D. (2017). Visibility and digital art: Blockchain as an ownership layer on the Internet. *Strategic Change, 26*(5), 461–470. https://doi.org/10.1002/jsc.2146

Monrat, A. A., Schelén, O., & Andersson, K. (2019). A survey of blockchain from the perspectives of applications, challenges, and opportunities, *IEEE Access. Institute of Electrical and Electronics Engineers Inc*., pp. 117134–117151. https://doi.org/10.1109/ACCESS.2019.2936094.

Neirotti, P., De Marco, A., Cagliano, A. C., Mangano, G., & Scorrano, F. (2014). Current Trends in Smart City Initiatives: Some Stylised Facts. *Cities* (38), 25–36.

Nelson, P. (1970). Information and Consumer Behavior. *Journal of Political Economy, 78*(2), 311–329.

Newman, P. W. (1999). Sustainability and Cities: Extending the Metabolism Model. *Landscape and Urban Planning, 44*(4), 219–226.

O'Dwyer, G. P. (2015). The economics of Bitcoin and similar private digital currencies. *Journal of Financial Stability, 17*, 81–91. https://doi.org/10.1016/j.jfs.2014.11.006

O'Dwyer, R. (2020). Limited edition: Producing artificial scarcity for digital art on the blockchain and its implications for the cultural industries. *Convergence: The International Journal of Research into New Media Technologies*, *26*(4), 874–894.

O'Brien, D. (2014). Cultural value, measurement and policy making. *Arts & Humanities in Higher Education, 14*(1), 79–94.

Paskaleva, K., Cooper, I., Linde, P., Peterson, B., & Götz, C. (2015). No Tit Stakeholder engagement in the smart city: Making living labs work. In *Transforming City Governments for Successful Smart Cities*. Cham: Springer, pp. 115–145.

Pessach, G. (2013). Deconstructing disintermediation—a skeptical copyright perspective. *Cardozo Arts & Entertainment Law Journal, 31*(3), 833–873.

Piccialli, F., & Chianese, A. (2018). Editorial for FGCS special issue: The internet of cultural things: towards a smart cultural heritage. *Future Generation Computer Systems, 81*, 514–515.

Pons, J. (2017). Blockchains and smart contracts in the culture and entertainment business. *Réalités Industrielles, 3*, 81–90.

Pratt, A. C. (2009). Urban regeneration: From the arts 'Feel Good' factor to the cultural economy: A case study of Hoxton London. *Urban Studies, 46*(5–6), 1041–1061.

Pratt, A. C. (2010). Creative cities: Tensions within and between social, cultural and economic development. A critical reading of the UK experience. *City, Culture and Society, 1*, 13–20.

Reed, M., Graves, A., Dandy, N., Posthumus, H., Hubacek, K., Morris, J., Prell, C., Claire, H., Quinn, C. H., & Stringer, L. C. (2009). Who's in and why? A typology of stakeholder analysis methods for natural resource management. *Journal of Environmental Management, 90*(5), 1933–1949. https://doi.org/10.1016/j.jenvman.2009.01.001.

Sasaki, M. (2010). Urban regeneration through cultural creativity and social inclusion: Rethinking creative city theory through a Japanese case study. *Cities, 27*, S3–S9.

Shelton, T., Zook, M., & Wiig, A. (2015). The actually existing smart city. *Cambridge Journal of Regions, Economy and Society, 8*(1), 13–25.

Shin, H., & Stevens, Q. (2013). How culture and economy meet in South Korea: The politics of cultural economy in culture-led urban regeneration. *International Journal of Urban and Regional Research, 37*(5), 1707–1723.

Sicilia, M. A., & Visvizi, A. (2019). Blockchain and OECD data repositories: Opportunities and policymaking implications. *Library Hi Tech, 37*(1), 30–42. https://doi.org/10.1108/LHT-12-2017-0276

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research, 104*, 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039

Stankovic, M. (2019). *Can Blockchain save the creative industry*? Medium. medium.com, Retrieved December 8, 2020, from https://medium.com/@mimi_stankovic/can-blockchain-save-the-creative-industry-5c212bb52ac2.

Tapscott, D., & Tapscott, A. (2018). *Blockchain revolution: how the technology behind Bitcoin is changing money, business and the world*. London: Pengion.

Throsby, D. (1998). *Economics and culture*. Cambridge: Cambridge University Press.
Throsby, D. (2008). The concentric circles model of the cultural industries. *Cultural Trends, 17*(3), 147–164.
Throsby, D. (2010). *The Economics of Cultural Policy*. Cambridge: University Press.
Torraco, R. J. (2005). Writing integrative literature reviews: Guidelines and examples. *Human Resource Development Review, 4*(3), 356–367. https://doi.org/10.1177/1534484305278283
Towse, R., & Handke, C. (2013). *Handbook on the Digital Creative Economy*. Cheltenham: Edward Elgar.
UNCTAD (2018). *Creative Economy Outlook. Trends in International Trade in Creative Industries*. Geneva: UNCTAD.
UNESCO (2013). *The Hangzhou Declaration Placing Culture at the Heart of Sustainable Development Policies*. Hangzhou: UNESCO.
UNESCO (2016). *Culture: Urban Future; Global Report on Culture for Sustainable Urban Development*. Paris: UNESCO.
Virolainen, J. (2016). Participatory turn in cultural policy?—An analysis of the concept of cultural participation in finnish cultural policy. *Nordisk Kulturpolitisk Tidsskrift, 19*(1), 59–77.
Visvizi, A., & Lytras, M. D. (2020). Sustainable smart cities and smart villages research: Rethinking security, safety, well-being, and happiness. *Sustainability, 12*(215), 1–4.
Visvizi, A., Lytras, M. D., Damiani, E., & Mathkour, H. (2018). Policy making for smart cities: Innovation and social inclusive economic growth for sustainability. *Journal of Science and Technology Policy Management, 9*(2), 126–133. https://doi.org/10.1108/jstpm-07-2018-079
Visvizi, A., Mazzucelli, C. G., & Lytras, M. (2017). Irregular migratory flows: Towards an ICTs' enabled integrated framework for resilient urban systems. *Journal of Science and Technology Policy Management, 8*(2), 227–242. https://doi.org/10.1108/JSTPM-05-2017-0020
Wang, S. (2016). The cloud, online piracy and global copyright governance. *International Journal of Cultural Studies, 20*(3), 270–286. https://doi.org/10.1177/1367877916628239
Warkentin, M., & Orgeron, C. (2020). Using the security triad to assess blockchain technology in public sector applications. *International Journal of Information Management, 52*, 102090. https://doi.org/10.1016/j.ijinfomgt.2020.102090
Whitaker, A. (2018). Artist as owner not guarantor: The art market from the artist's point of view. *Visual Resources, 34*(1–2), 48–64. https://doi.org/10.1080/01973762.2018.1435609
Whitaker, A., Bracegirdle, A., de Menil, S., Gitlitz, M. A., & Saltos, L. (2020). Art, antiquities, and blockchain: new approaches to the restitution of cultural heritage. *International Journal of Cultural Policy*, pp. 1–18. https://doi.org/10.1080/10286632.2020.1765163, Available at: https://www.crowell.com/files/20200612-Art-antiquities-and-blockchain-new-approaches-to-the-restitution-of-cultural-heritage.pdf. Accessed 8 Dec. 2020.
Xu, M., Chen, X., & Kou, G. (2019). A systematic review of blockchain. *Financial Innovation, 5*(1), 1–17. https://doi.org/10.1186/s40854-019-0147-z. Accessed 8 Dec. 2020.
Zeilinger, M. (2018). Digital art as "Monetised Graphics": Enforcing intellectual property on the blockchain. *Philosophy and Technology, 31*(1), 15–41. https://doi.org/10.1007/s13347-016-0243-1

Radosław Malik Ph.D., Assistant Professor, Institute of International Studies (ISM), SGH Warsaw School of Economics, Warsaw, Poland. His research interests include services, offshoring, and the labor market.

Anna Anetta Janowska Ph.D., Assistant Professor, Department of Public Policy, SGH Warsaw School of Economics, Warsaw, Poland. Her research interests include cultural and creative sectors, digitization of culture, free culture, copyright in the digital environment and cultural policy.

Katarzyna Maria Ciupa Ph.D. Candidate, SGH Warsaw School of Economics, Warsaw, Poland. Her research interests include financial technology (FinTech) with a focus on blockchain, financial innovations including crypto-assets and blockchain-powered financing schemes, and financial intelligence.

The Evolution of the Smart City in Italy: An Empirical Investigation on the Importance of Smart Services

Antonio Botti and Antonella Monda

Abstract This chapter aims to bring to light the most used and requested smart city services to suggest to public managers the areas on which they should work to foster the development of the smart city. Starting from an overview of the smart city concept, the chapter offers an in-depth analysis of smart services in the Italian context. Based on an empirical investigation, the study aims to analyze the most popular services used by citizens and the areas in which policymakers should intervene to raise Italian smart cities. By analyzing the results, we try to provide interesting suggestions that can make improvements to the management of the Italian services.

Keywords Smart city · Smart services · Technology · Smart ecosystem

1 Introduction

The city has great relevance in the economic, environmental and social development process. Therefore, it is necessary to rethink urban spaces, rationalizing resources and making the provision of services more efficient. These needs lead to the emergence of the smart city phenomenon.

A smart city is a city that uses its resources in a "smart" way, aiming at becoming economically sustainable, energy self-sufficient and attentive to the quality of citizens life. Furthermore, the term smart city is intended as a city that, through Information and Communications Technology (ICT), favors citizens' participation in the definition and implementation of an integrated system of sustainable urban policies aimed at improving the quality of life and the well-being of citizens (OECD, 2020).

During the years, the phenomenon of smart city has been studied from different perspectives and by scholars of different disciplines, therefore the literature doesn't

A. Botti · A. Monda (✉)
Department of Business Science - Management & Innovation Systems, University of Salerno, Fisciano, Italy
e-mail: anmonda@unisa.it

A. Botti
e-mail: abotti@unisa.it

A. Visvizi and O. Troisi (eds.), *Managing Smart Cities*,
https://doi.org/10.1007/978-3-030-93585-6_14

offer a shared definition of the smart city. Despite the multidisciplinary approach to the phenomenon, the argument most often debated among scholars concerns how ICT can improve services and make a smart city more efficient. Several studies focus on citizens' perception of smart services, to provide useful insights for policymakers (Lytras & Visvizi, 2020; Lytras et al., 2020).

Although the extensive international literature on the topic, there is a lack of recent studies on Italian citizens' perception of smart services. According to data from a 2012 study (TEH-Ambrosetti, 2012), Italian citizens would have little knowledge of the smart city phenomenon; 4 out of 5 Italians had never heard the word "smart city". Today, almost 10 years later this study, many steps forward have been made. Many Italian cities stand out for their economic solidity and sustainable mobility, social qualities and digital transformation (ICity Rank 2019).

Based on this information, this chapter aims to fill the gap in the literature by updating the data relating to Italian citizens' perception of smart services. Particularly, this research aims to bring to light the most used smart city services and the most requested smart services, to understand what are the smart services used by the Italian population and to suggest to public managers the areas on which they could work to support the development of Italian smart cities.

Specifically, the chapter wants to answer the following research questions:

RQ1: What are the smart services most used and most requested by Italian citizens?

RQ2: What are the areas in which policymakers should intervene to make Italian smart cities efficient?

The chapter starts with an overview of the smart city concept, including the different definitions and dimensions. The importance of smart collaboration is highlighted, in line with the recent service theories (such as Service-Dominant Logic—Vargo & Lusch, 2004, and Service Science—Maglio et al., 2006). Moreover, an overview of events and experiences related to smart services in the Italian context is proposed. Based on an empirical investigation, the study analyzes the most used and most requested services by Italian citizens. The results show how the smart rethinking of urban areas can be one of the solutions to environmental and social problems and can promote economic growth, thanks to the opportunities offered by new technologies.

2 Theoretical Background

2.1 Smart City Definition

Over the past decade, the concept of smart city has been at the centre of numerous debates that gave rise to a wide range of definitions aimed at identifying the characteristics of the phenomenon and the development processes that transform an urban agglomeration into a smart city. Particularly, two events contributed to the smart city

development (Cocchia, 2014): urbanization and ICTs spread. The concomitance of these two events led to the concept of smart city, which was initially intended as a city in which urban problems are solved thanks to ICT.

The concept of smart city, over time, has evolved into a holistic vision that effectively addressed different fields (Toppeta, 2010): services, participatory policies, social inclusion, economy, environmental protection, governance for sustainable development. For this reason, several scholars point out that smart city research requires interdisciplinary and multidisciplinary approaches to cover the multitude of topics and issues relevant to the field (Kitchin, 2015, Visvizi and Lytras 2018a). Such cross-fertilization among different fields of research aims at generating added value for the inhabitants of a city, through the use of ICT (Visvizi and Lytras, 2018b; De Maio et al., 2015).

Due to the different perspectives of analysis of the phenomenon, in the literature, there is still no clear and common definition of the smart city shared by the academic, political and industrial world. The smart city is a poorly defined concept (Albino et al., 2015). Depending on the meaning attributed to the word "smart", a different definition of the smart city follows. Cocchia (2014, p.19) analyzes different meanings of "smart" word and lists all the definitions used in the literature to describe a smart city. His result led to many definitions, such as intelligent city, knowledge city, ubiquitous city, digital city, sustainable city, virtual city, smart community, learning city.

The common element of all the abovementioned definitions is the impact of technologies on new forms of policy and planning (Hollands, 2008; Schuler, 2002; Anthopoulos & Fitsilis, 2010; Komninos, 2006; Couclelis, 2004; California Institute, 2001; Ergazakis et al., 2004, OECD, 1999, 2010; Batagan, 2011). In particular, the extended concept of the smart city represents the perfect synthesis of a series of elements and characteristics aimed at promoting environmental sustainability and socio-economic development, through key objectives, which are mainly expressed: in the improvement of environmental conditions in terms of reduction of carbon dioxide emissions, pollutants and waste disposal (OECD, 2010), in the use of renewable energy sources (Batagan, 2011), in the dissemination of knowledge understood as the capacity and competence thanks to which stakeholders of the smart city can take full advantage of innovative products and services, drawing socio-economic advantages (OECD, 1999; Ergazakis et al., 2004; Komnios, 2006).

Furthermore, the smart city aims to encourage the active involvement of all actors through the dissemination of e-government and e-democracy tools, focusing on improving the level of quality of life and well-being of citizens (Couclelis, 2004; California Institute, 2001). A city, therefore, can be considered "smart" if it integrates and synthesizes data produced by any type of sensor to improve the efficiency, sustainability, equity and quality of life of the city itself. Among the many definitions of the smart city, taking into account the different aspects abovementioned (Caragliu et al., 2011; Dameri, 2012; Hall, 2000), we propose a complete definition of all the elements discussed above. It is the definition of the Cassa Depositi e Prestiti (2013) that defines the smart city as a city that, according to a strategic vision and in an organic way, uses ICT tools as an innovative support for management areas and

in the provision of public services to improve the livability of its citizens. It is a city that uses information from various fields in real-time and exploits both tangible resources (e.g. transport infrastructures, energy and natural resources) and intangible (human capital, education and knowledge, the intellectual capital of companies). A city capable of aiming at an abstract projection of the community of the future […] and that aims to improve the lives of citizens by guaranteeing the lowest possible environmental impact.

2.2 Smart City Dimensions

In the document "Mapping smart cities in the EU", European Parliament's Committee on Industry, Research and Energy (ITRE) stated that in any smart city initiative or project there must be at least one of the six characteristics listed in the European smart city project. Six characteristics are smart economy, smart mobility, smart governance, smart environment, smart people, smart living.

The first domain of application of the initiatives (smart economy) refers to the set of projects and activities that exploit ICT for the performance and development of their business, the promotion and trade of goods and services. The smart economy favors the birth of new ideas and new products and new entrepreneurship models. The strong point on which smart economy leverages is the innovative spirit that must distinguish the smart city: an intelligent economy is innovative, closely linked to entrepreneurship, and can promote at the same time a high-quality environment, greater security of energy supply as well as economic and social cohesion.

The second domain of application of the initiatives (smart mobility) is defined by the World Business Council for Sustainable Development, "the possibility of moving freely, communicating and establishing relationships without ever losing sight of the human and environmental aspects, today as in future". Smart mobility is citizen-friendly mobility and allows the management of mobility flows to reduce congestion, downtime, inefficiencies and risks, also providing citizens with services tailored and customized.

The third area of the mentioned list (smart governance) concerns the administration. By smart governance we mean the inclusive process of balanced and rational management of resources, collaboration and integration between public, private, civil and European organizations so that the city can function efficiently and effectively as a single body. Technology is a fundamental tool at the service of governance for the achievement of the objectives of the smart city, as it allows, through public-private partnerships, the collaboration between the different actors who live and work in cities. More specifically, ICTs are tools used to allow connection among actors, to ensure transparency, and to remove the obstacles to innovative development posed by bureaucratization. On the one hand, ICT could ensure a more fluid use of the services offered to citizens and, on the other hand, would encourage their active participation in the administrative life of the city.

The fourth dimension is the smart environment. Smart environments are the use of renewable energy sources, the monitoring of pollution, the management and reduction of waste through separate collection, the planning of sustainable buildings, the use of smart grids and intelligent lighting.

The fifth characteristic of the smart city is Smart People. It acts as a common thread for the other characteristics and represents the enhancement of human capital. In a smart city, citizens represent the elements capable of developing and sharing ideas and technologies in their local context and transferring them to the global world. Smart citizens possess technical skills and the ability to use ICT. He's able to provide input to the community in various sectors. The smart city, therefore, supports co-planning and collaboration between the different actors, through a direct relationship between citizens and institutions, based on mutual trust.

Finally, it should be emphasized how the involvement and collaboration of the main actors of a city are a fundamental requirement to make it possible to integrate the technologies that favour the development of Smart Living. This area refers to the lifestyle, behaviour and consumption of citizens, and is related to high levels of social cohesion and the development of social capital. As happens in the mobility sector (Ning et al., 2017), domestic life and the urban environment (Liu et al., 2015), also in health (Botti & Monda, 2020), safety (Lacinák & Ristvej, 2017), culture and tourism sectors (Troisi et al., 2019a; Polese et al., 2018) smart components come into force to improve the landscape and environmental enhancement of a territory, as well as to create a more sustainable use. Smart living is related to those innovative and intelligent technology solutions that make life easier for a citizen, whether they are used inside a home, in the cultural and artistic sphere, in the service and catering sector, in mobility and in the intelligent way of moving within an urban context.

Finally, the transformation towards a "smarter" city is complete when innovation is also present in planning and management operations (Naphade et al., 2011). A city that intends to become smart must, that is, assess its innovation needs and opportunities, prioritize development efforts, set clear goals and metrics that allow city planners, ICT consultants and residents to assess progress. Developing a city strategy is the most complex but fundamental step to becoming a smart, differentiated and attractive city: evaluating the main systems and activities of a city represents the first step towards more sustainable prosperity, through the use of solutions and practices of intelligent management.

2.3 Smarter City and Smart Collaboration

Each city is a complex network of actors and components: citizens, businesses, transport, communications, energy, services. The integration of these elements and actor involvement and collaboration are the basic elements of a smart city. To achieve new levels of effectiveness and efficiency a series of interdependent public and private systems are integrated and optimized in a smart city. For this reason, Naphade et al. (2011) define smart city as a "system of systems". The systems that make up the smart

city are, at the same time, producers and beneficiaries of information, promoting a resource exchange of information.

From this point of view, the concept of smart city is in line with some recent service theories, such as Service-Dominant logic (Vargo & Lusch, 2004, 2008, 2011) and Service Science (Maglio & Spohrer, 2008; Maglio et al., 2006), which adopt a holistic vision to the service management and which emphasize the role of technology and knowledge exchange. Such theories focus on a service-based logic according to which, in economic exchange, the collaboration between two or more actors becomes central, as it fosters knowledge and skills exchange, generating value and improving the well-being of all participants to the exchange (Vargo & Lusch, 2004). Specifically, these theories argue that the resource exchange is facilitated by the predominant role of ICT, that speed social learning and helps engagement among actors (Maglio et al., 2006).

The re-reading of the smart city in the light of service theories highlights the development of collaborative logics among smart city actors, resulting in continuous processes of cooperation between public and private decision-makers and citizens, allowing multiplying moments of value creation as a result of synergistic interactions (Polese et al., 2019). In this logic, all the actors in the system take on the same importance, including citizens who are increasingly involved in service design or delivery (Nambisan & Baron, 2009). The involvement of all the actors in service design promotes the social growth of all stakeholder groups in the ecosystem (Troisi et al., 2019b).

The smart city is here understood as a smart community that aims to emphasize the need to develop innovative solutions through a collaborative approach that meets important societal challenges (Lytras & Visvizi, 2018). In this context, smart technology is considered a key lever for community well-being that fosters the emergence of sustainable growth (California institute, 2001; Ciasullo et al., 2020; Eger, 2009).

Furthermore, technology is fundamental for resource exchange among all community stakeholders (Piciocchi et al., 2013), especially for immaterial resources exchange (including information, know-how, personal experience, feedback) that allow service providers to improve service based on users' judgments and suggestions (Polese et al., 2018; Vargo & Lusch, 2008).

So that collaboration between smart community actors take place, it is necessary to facilitate the exchange of intangible resources and to know the point of view of users on smart services. Regarding this last point, Lytras et al. (2020) propose a categorization to capture user perceptions of smart city services and applications. The proposed classification, useful for managers and policymakers, has five dimensions: technological anxiety, work-life interface, orientation for involvement, support orientation, quality of life. The first dimension (technological anxiety) represents user anxiety and distrust of the use of intelligent services. The second dimension (the work-life interface) represents end-users' perception of the usefulness and usability of smart city applications for their personal and professional life. The third dimension (orientation for involvement) represents the inclination of end-users to exercise their civic rights and duties. The fourth dimension (support orientation) demonstrates the perception of end-users of the usability and friendliness of smart city services and applications

to help and assist citizens. Finally, the fifth dimension (quality of life) outlines the belief of end-users that smart city services improve the living standards of inhabitants. These dimensions represent useful information to develop user-friendly smart-city solutions.

3 Italian Smart Cities

Italy has the most cultural heritage in the world (1st in the ranking concerning tourism and cultural heritage according to the Country Brand Index, 2014–2015) and unique environmental heritage in the world, with its coasts, its reserves and natural landscapes. However, in the transition to the smartness of Italian urban systems, Italy starts with some delay and suffers the weakness of not having large cities.

The strong local identity and the absence of megacities affect the smart development of Italian cities and the need to find an Italian way to the smart city. These conditions led to the awareness that Italy must avoid the simple repetition of urban models developed in other contexts. The most widespread model of smart city, evolved above all in European metropolitan cities, risks producing generalizations deriving from the use of standard technologies, which often fail to enhance local identities, importing development ideas and actions not commensurate with the needs of citizens, the peculiarities of the context and the preliminary conditions of the cities. The Italian protocol on smart cities, on the other hand, intends to be based on the peculiarities of the local area and on strategies for enhancing them, working on themes such as the landscape, cultural attractions, identity, authenticity of Italian territories, accessibility, connectivity and opportunities. Technological innovations and planning strategies in Italy should therefore favor individual and collective well-being, in an approach that we can define as "human-oriented".

In line with these objectives, Italian smart cities are characterized by (TEH-Ambrosetti, 2012):

- A not very large area that mainly exploits existing infrastructures (brownfields) by equipping them with ICT (also from a sharing economy perspective, such as spaces dedicated to co-working);
- Use of ICT tools to improve the quality of life of citizens;
- An active citizens involvement with a view to e-democracy where each aim for their well-being;
- Supranational directives on sustainable (protection for the environment) and smart development (diffusion of technologies and reduction of the digital divide);
- Decentralized governance to local authorities that follows a bottom-up approach, characterized by a low ability to find sources of financing (which derive for the most part from European funds) which encourages the use of alternative forms of financing such as crowdfunding.

Due also to this last characteristic, the situation relating to the development of Italian Smart cities appear fragmented. Although many Italian Cities meet the criteria

of smartness and have obtained recognition at a European level (EY, 2020), in Italy, there is an accentuated fragmentation and dispersion of initiatives; tendency to self-organization, together with a very heterogeneous set of solutions generically labelled as "smart" (TEH-Ambrosetti, 2012). The uneven development of smart initiatives is also reflected in the distribution of smart cities along the peninsula. Smart cities are not equally distributed throughout the territory, with a higher concentration in the north of the country (smart city Index of EY 2020). Since it is necessary to align policies and increase knowledge but above all to have a clear idea of the current Italian situation, we surveyed on the perception of Italian citizens on smart services.

4 Methodology

Empirical research carried out to analyze and identify the most used smart city services and the most requested services by Italian citizens is presented, to provide an overview of the phenomenon under study.

We wanted to question, on an exploratory basis, Italian cities to identify at what point in the evolutionary process towards a smart path they are.

For this purpose, we decided to use the structured questionnaire technique, in which the questions are administered in the same order and with the same terms (Bichi, 2003). More specifically, the survey was administering through an anonymous online questionnaire to a sample of people through a system that allows the data received. Respondents were asked to express opinions on the smart city services.

The interviewees were not selected through a probabilistic sampling procedure (Corbetta, 1999) but only based on the criterion of greater availability. Although this may be a limit, the statistical need to inferentially extend the data collected from the sample to the population is not part of our objectives, especially given the exploratory nature of the survey.

The survey made possible, mainly, to understand the needs and requirements of individuals, the services they generally use, the perception they have of smart city services, to encourage the development of services that on the one hand are in able to improve the well-being of citizens and the liveability of cities, on the other hand, that they pay particular attention to the protection and care of the environment.

We investigated the most used and most requested services by Italian citizens. In do this, we follow the categorization introduced by Lytras et al. (2020), which explore the underlying dimensions of users' perceptions of smart city services. The categorization developed by Lytras et al. (2020), appears to be appropriate for the measurement of such a multidimensional construct. It is composed of the following dimensions: technology anxiety, work-life interface, engaged orientation, support orientation and quality of life. For each dimension, we asked several questions. The answers for each category are not mutually exclusive, so respondents could give multiple answers.

5 Results

5.1 Profile of Respondents

The sample socio-demographic characteristics are shown in Table 1.

The sample is made up of 204 individuals, represented by the female gender for 54.9% and the male gender for 45.1%. The age of the individuals interviewed defines a fairly wide range. The sample includes people aged between 23 and 75, of which 16.3% under 24, 60.6% between 34–25 years, 15.4% between 54–35 years, 7.7% between 75–55 years.

As regards the distribution of the sample regarding the level of education achieved, it emerges that 1% of the individuals interviewed did not attend school, 2.9% attended primary school, 43.3% attended high school, 29.8% obtained a three-year

Table 1 Sample summary characteristics

Sample description		%
Gender	Male	40.4
	Female	59.6
Age	< 24	16.3
	25–34	60.6
	35–54	15.4
	55–75	7.7
The highest level of education	None	1
	Elementary school	2.9
	High school	43.3
	Bachelor's degree	29.8
	Master's degree	21.2
	Research doctorate	1.9
Number of inhabitants	Up to 10.000	26
	Up to 100.000	52
	Up to 1.000.000	13.5
	Above 1.000.000	8.5
Employement by sector	Academia	16.3
	Business sector	46.2
	Non-governamental sector (NGOs)	6.8
	Homemaker	4.8
	Unemployed	5.8
	I plan my own business	20.1

Source author's elaboration

degree, 21.2% awarded a master's degree, 1.9% continued their path with a research doctorate. Therefore, most interviewees got a high school diploma.

The sample lives in Italy. The cities in which interviewees reside foresee a number of inhabitants up to 10,000 (26%), up to 100,000 (52.9%), up to 1,000,000 (13.5%) and over 1,000,000 (7.7%).

Finally, about the work of the interviewees and the work they intend to carry out in the future, 46.2% are involved in the commercial sector, 16.3% employed in the academic field, 6.8% work in the non-governmental sector (NGO), 21.2% intend to start their own business in the future, 5.8% of individuals do not have a job and therefore are unemployed and finally, 4.8% take care of the family and children. Most people work in the commercial sector or intend to work in this area in the future.

5.2 *Results of Smart City Services*

The main results of our survey are shown below. Through the survey it is possible to define how often people use smart city services: 30.8% use them daily, 15.4% a few times a week, 6.7% once a week, 13, 5% a few times a month, 3.8% once a month, 12.5% less than once a month and finally 17.3% do not use these services (Fig. 1).

Most of the sample uses the smart city services out of necessity (39.3%), for ease of use (18%) or convenience (17.2%).

Figure 2 shows the categories of services and smart applications that the sample claims to know and have used. The results obtained show that electronic parking services, e-transport services and services related to entertainment are mostly used.

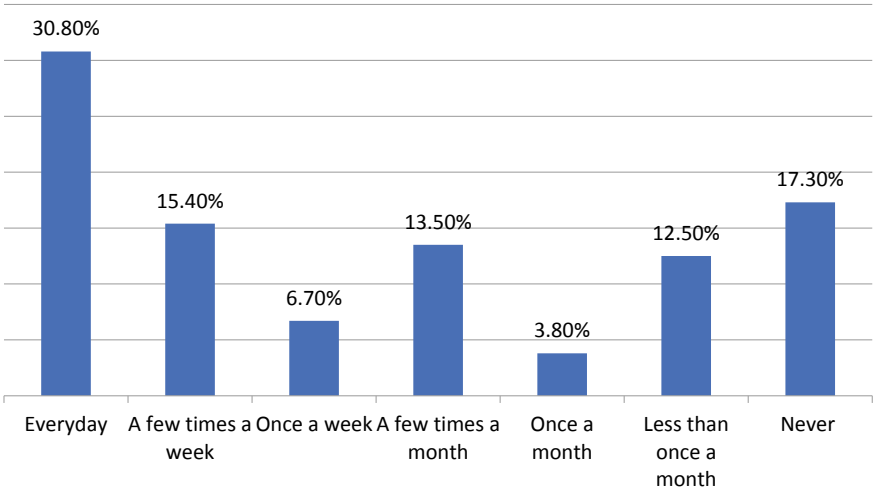

Fig. 1 Distribution of the sample for the use of smart city services. *Source* author's elaboration

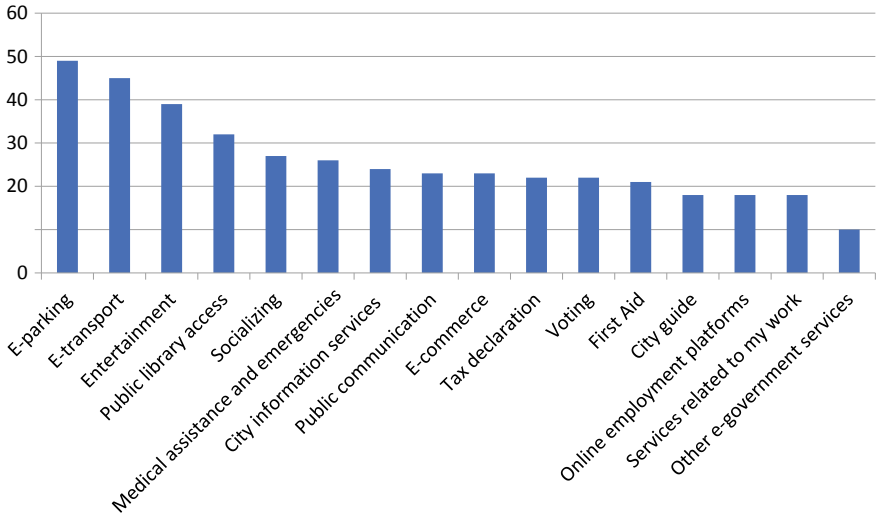

Fig. 2 Smart city services known and used at least once by the sample. *Source* author's elaboration

The empirical survey conducted also allowed us to know, approximately, which smart city services are regularly used by the respondents (Fig. 3).

As shown in Fig. 3, three services most used by citizens are e-transport services (51), urban wi-fi (43) and electronic parking services (15). It also emerged that for the use of these smart services, individuals mostly use mobile phones (74.6%) and computers (11.5%).

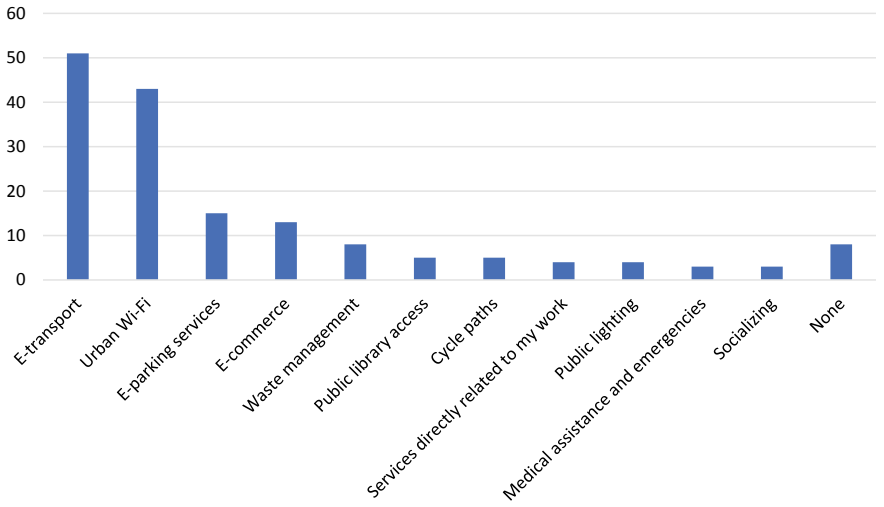

Fig. 3 Smart services used regularly. *Source* author's elaboration

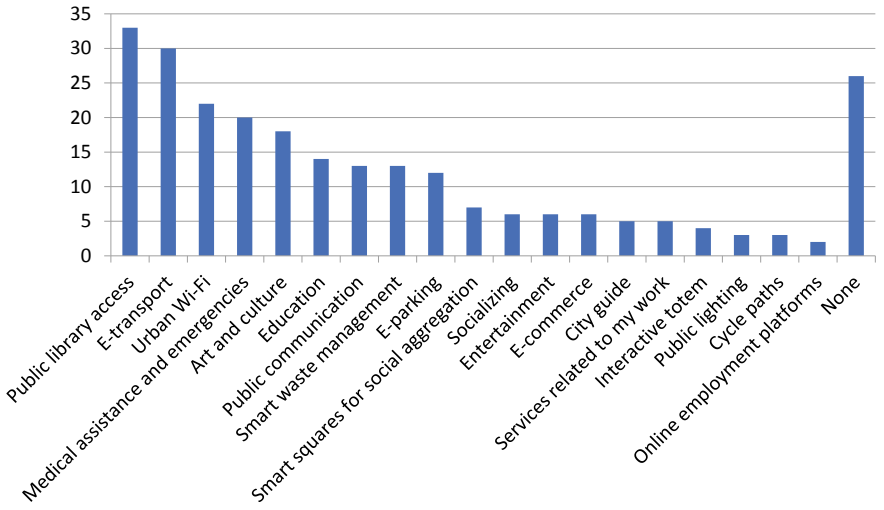

Fig. 4 Smart City services to improve quality of life and well-being. *Source* author's elaboration

The analysis also revealed that the main services considered essential for the improvement of personal development and for improving the quality of life and well-being are (Fig. 4): access to public libraries, e-transport, urban wi-fi, medical and health care, art and culture and education.

Based on the classification of Lytras et al. (2020), we asked a series of questions to investigate citizens' perception of smart services. For each category, we asked several questions. The answers for each category are not mutually exclusive, so respondents could give multiple answers. The main results show that:

- 25% of the sample think that city lack basic infrastructure, so smart-city services are a pointless luxury;
- 53.3% of the sample believe that job opportunities improve the general quality of life;
- 80.3% of the sample would like to see more services that enable citizen to be responsible for political life;
- 71.3% of the sample would like to see more services that allow citizen to actively participate in community life;
- 80.3% of the sample would like to see more services that enable citizen to easily locate cultural events in cities;
- 66.4% of the sample would like to see more services that allow citizen to help others and to contribute to the shared economy models;
- 86.1% of the sample would like to see more services that allow citizen to actively engage in actions aimed at environmental sustainability;
- 82.1% of the sample would like more services that meet the needs and capabilities of the elderly;

– 93.4% of the sample requires more services that help citizen in real-time in case of threats or dangerous situations;
– 82% of the sample would like more services that improve the quality of life.

6 Discussions and Conclusions

The work accomplishes two main results related to its research questions: (1) the identification of the most used and requested smart services in Italy, (2) the identification of areas in which policymakers should intervene to raise Italian smart cities efficiency.

Regarding the first research question, results show that the services most used by Italian citizens are e-transport services, urban Wi-Fi, electronic parking services, e-commerce and smart waste management. The most requested services are: public libraries, e-transport, urban wi-fi, medical and health care, art and culture and education.

Regarding the second research question, to identify the areas in which policymakers should intervene we referred to the classification by Lytras et al. (2020). Following such categorization, we analyze our results based on the five dimensions of users' perceptions of smart city services (technology anxiety, work-life interface, engaged citizenship, support orientation and quality of life).

Regarding the "technological anxiety" dimension, the survey results show that only a part of the sample is concerned about the return on investment in smart city services. Only 25% of the sample believes that cities lack basic infrastructure and smart city services are a useless luxury.

Regarding the dimension of "engagement orientation", the sample shows a strong component of involvement in smart city services requested. 80.3% of the sample would like more services capable of involving and making citizens more responsible for political life, 71.3% of the sample would like more services that allow them to actively participate in community life, 80.3% of the sample would like more services that allow citizens to easily locate cultural events in cities; 86.1% of the sample would like more services that allow citizens to actively engage in actions aimed at environmental sustainability.

Regarding the "work-life interface" dimension, although only a small percentage of the sample regularly requests and uses smart services specifically related to work, the empirical survey also shows that smart city services that improve and optimize the quality of life of citizens are mainly linked to the development of new job opportunities for 53.3% of respondents.

As regards the "quality of life" dimension, 82% of the sample would like more services that improve the quality of life.

Finally, regarding the "support orientation" dimension, users show a strong will to use services that offer support in emergencies and that can help people in difficulty. 66.4% of the sample would like more services that would contribute to the shared economy model and help others, 82.1% of the sample would like to see more services

corresponding to the needs and skills of elderly people, 93.4% of the sample requires more services that help in real-time in case of threats or dangerous situations.

Ultimately, the sample is inclined to use smart city services, especially related to the involvement of citizens, the support of the weakest and the improvement of life in general. Therefore, public decision-makers could conceive practices aimed at encouraging user involvement.

In line with the highly engaging personality of Italians, users foster social responsibility and are require the provision of engagement services and community-based activities. Among the required engagement services, cultural activities play an important role. Most of the respondents intend to improve their personal development by access to libraries and culture, through education and participation in educational activities organized for citizens.

Most of the respondents think infrastructures play a role of primary importance as regards the organization of life (e.g. traffic management, waste collection, electricity). Only a small percentage of the sample believes that infrastructures have secondary importance in daily life.

The analysis also shows that a large part of the sample (80.3%) believes that smart city services help increasing citizen involvement in community life, increasing social sustainability and improving well-being and quality of life. At the same time, a slice of the sample (over 20%) does not use smart city services at all. We deduce that in Italy, there is still no collective, tangible and concrete push towards change in terms of smart services. Therefore, it would be desirable to accelerate the proposal and spread of smart city services by public bodies in these areas, to shift traditional services into a smart key, improving both the citizens' life and cities livability.

Furthermore, in Italy, where miss large metropolises and strong cultural identity exists, it is not possible to think of transforming urban centres into futuristic megalopolises. The competitive advantage that emanates a unique artistic and cultural heritage in the world, and social capital among the most solid in the world, must be enhanced. These characteristics represent an opportunity to formulate an original idea of a smart city, hoping in a uniformly smarter country, in which system competitiveness and well-being of citizens are combined.

References

Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart cities: Definitions, dimensions, performance, and initiatives. *Journal of Urban Technology, 22*(1), 3–21.

Anthopoulos, L., & Fitsilis, P. (2010). From digital to ubiquitous cities: defining a common architecture for urban development. *IEEE 6th International conference on Intelligent Environments*, pp. 301–306. IEEE Xplore.

Batagan, L. (2011). Smart cities and sustainability models. *Revista De Informatica Economica, 15*(3), 80–87.

Bichi R. (2003). Il disegno della ricerca. In: V. Cesareo, ed., *I protagonisti della Società civile*, Rubbettino, Soveria Mannelli.

Botti, A., & Monda, A. (2020). Sustainable value co-creation and digital health: The case of Trentino eHealth ecosystem. *Sustainability, 12*(13), 5263.
California Institute (2001) http://smartcommunities.org/concept.php.
Caragliu, A., Del Bo, C. & Nijkamp, P. (2011). Smart cities in Europe. Journal of Urban Technology, 18(2), pp. 65–82
Ciasullo, M. V., Troisi, O., Grimaldi, M. & Leone, D. (2020). Multi-level governance for sustainable innovation in smart communities: an ecosystems approach. *International Entrepreneurship and Management Journal*, pp. 1–29.
Cocchia, A. (2014). Smart and Digital City: A Systematic Literature Review. In R. P. Dameri & C. Rosenthal-Sabroux (Eds.), *Smart City: How to Create Public and Economic Value with High Technology in Urban Space* (pp. 13–43). Springer.
Corbetta, P. (1999). Metodologia e tecniche della ricerca sociale.
Couclelis, H. (2004). The construction of the digital city. *Planning and Design, 31*(1), 5–19.
Dameri, R. P. (2012). Defining an evaluation framework for digital cities implementation. IEEE International Conference on Information Society (i-Society), pp. 466–470. IEEE Xplore.
De Maio, C., Botti, A., Fenza, G., Loia, V., Tommasetti, A., Troisi, O. & Vesci, M. (2015). What-if analysis combining fuzzy cognitive map and structural equation modeling. In: *2015 Conference on Technologies and Applications of Artificial Intelligence (TAAI),* pp. 89–96. IEEE.
Eger, J. M. (2009). Smart growth, smart cities, and the crisis at the pump a worldwide phenomenon. *I-WAYS-the Journal of E-Government Policy and Regulation, 32*(1), 47–53.
Ergazakis, M., Metaxiotis, M., & Psarras, J. (2004). Towards knowledge cities: Conceptual analysis and success stories. *Journal of Knowledge Management, 8*(5), 5–15.
Hall, P. (2000). Creative cities and economic development. *Urban Studies, 37*(4), 633–649.
Hollands, R. G. (2008). Will the real smart city please stand up?. *City: Analysis of Urban Trend, Culture, Theory, Policy, Action*, 12(3), pp. 303–320.
Kitchin, R. (2015). Making sense of smart cities: Addressing present shortcomings. *Cambridge Journal of Regions, Economy and Society, 8*(1), 131–136.
Komninos, N. (2006). The architecture of intelligent cities: integrating human, collective and artificial intelligence to enhance knowledge and innovation. IEEE 2nd IET International Conference on Intelligent Environments, pp. 13–20. IEEE Xplore.
Lacinák, M., & Ristvej, J. (2017). Smart city, safety and security. *Procedia Engineering, 192*, 522–527.
Liu, J., Li, Y., Chen, M., Dong, W., & Jin, D. (2015). Software-defined internet of things for smart urban sensing. *IEEE Communications Magazine, 53*(9), 55–63.
Lytras, M. D., & Visvizi, A. (2018). Who uses smart city services and what to make of it: Toward interdisciplinary smart cities research. *Sustainability, 10*(6), 1998.
Lytras, M. D., & Visvizi, A. (2020). Information management as a dual-purpose process in the smart city: Collecting, managing and utilizing information. *International Journal of Information Management*. https://doi.org/10.1016/j.ijinfomgt.2020.102224
Lytras, M. D., Visvizi, A., Chopdar, P. K., Sarirete, A., & Alhalabi, W. (2020). Information Management in Smart Cities: Turning end users' views into multi-item scale development, validation, and policy-making recommendations. *International Journal of Information Management*. https://doi.org/10.1016/j.ijinfomgt.2020.102146
Maglio, P. P., & Spohrer, J. (2008). Fundamentals of Service Science. *Journal of the Academy of Marketing Science, 36*, 18–20.
Maglio, P. P., Srinivasan, S., Kreulen, J. T., & Spohrer, J. (2006). Service Systems, Service Scientists, SSME, and Innovation. *Communications of the ACM, 49*, 81–85.
Nambisan, S., & Baron, R. A. (2009). Virtual customer environments: Testing a model of voluntary participation in value co-creation activities. *Journal of Product Innovation Management, 26*, 388–406.
Naphade, M., Banavar, G., Harrison, C., Paraszczak, J., & Morris, R. (2011). Smarter cities and their innovation challenges. *Computer, 44*(6), 32–39.

Ning, Z., Xia, F., Ullah, N., Kong, X., & Hu, X. (2017). Vehicular social networks: Enabling smart mobility. *IEEE Communications Magazine, 55*(5), 16–55.
OECD (1999). *Learning cities: the new recipe in regional development*.
OECD (2010). *Green Cities Programme.* http://www.oecd.org/gov/regional-policy/49318965.pdf.
OECD (2020). *Smart city and Inclusive growth, Building on the outcomes of the 1st OECD Roundtable on smart cities and Inclusive Growth* http://www.oecd.org/cfe/cities/OECD_Policy_Paper_Smart_Cities_and_Inclusive_Growth.pdf
Piciocchi, P., Bassano, C., Spohrer, J., Fisk, R., Enhancing Place Reputation of Local Service Systems in the Performing Arts Perspective. *An analysis of regional cases*, 2013, 1–18.
Polese, F., Botti, A., Grimaldi, M., Monda, A., & Vesci, M. (2018). Social innovation in smart tourism ecosystems: How technology and institutions shape sustainable value co-creation. *Sustainability, 10*(1), 140.
Polese, F., Botti, A., Monda, A., & Grimaldi, M. (2019). Smart city as a Service System: A Framework to Improve Smart Service Management. *Journal of Service Science and Management, 12*, 1–16.
Schuler, D. (2002). Digital cities and digital citizens. In: M. Tanabe, P. van den Besselaar and T. Ishida, eds., *Digital cities II: computational and sociological approaches*. LNCS, vol. 2362, pp. 71–85. Berlin: Springer.
The European House - Ambrosetti, ABB Group (2012). *Smart cities in Italia: un'opportunità nello spirito del Rinascimento per una nuova qualità della vita*, Milano.
Toppeta, D. (2010). The smart city vision: How innovation and ICT can build smart, "livable", sustainable cities. *The Innovation Knowledge Foundation, 5*, 1–9.
Troisi, O., Grimaldi, M., & Monda, A. (2019). Managing Smart Service Ecosystems Through Technology: How ICTs Enable Value Cocreation. *Tourism Analysis, 24*(3), 377–393.
Troisi, O., Ciasullo, M. V., Carrubbo, L., Sarno, D., & Grimaldi, M. (2019). Meta-management for sustainability in territorial ecosystems: The case of Libera's social reuse of territory. *Land Use Policy, 84*, 138–153.
Vargo, S. L., & Lusch, R. F. (2004). Evolving to a New Dominant Logic for Marketing. *Journal of Marketing, 68*, 1–17.
Vargo, S. L., & Lusch, R. F. (2008). Service-Dominant Logic: Continuing the Evolution. *Journal of the Academy of Marketing Science, 36*, 1–10.
Vargo, S. L., & Lusch, R. F. (2011). It's All B2B and beyond: Toward a Systems Perspective of the Market. *Industrial Marketing Management, 40*, 181–187.
Visvizi, A., & Lytras, M. D. (2018). It's Not a Fad: Smart cities and Smart Villages Research in European and Global Contexts. *Sustainability, 10*, 2727.
Visvizi, A., & Lytras, M. D. (2018b). Rescaling and refocusing smart cities research: From mega cities to smart villages. *Journal of Science and Technology Policy Management*, 9(2), pp. 134–145

Antonio Botti Ph.D., Full Professor of Management, Department of-Management & Innovation Systems (DISA-MIS), University of Salerno, Fisciano, Italy - Affiliate Research Fellow at Ipag Business School, Paris. Antonio Botti is a member of various Editorial Committees of Italian and foreign academic journals. Recently, his research activity has focused on entrepreneurship and issues related to performance evaluation.

Antonella Monda Ph.D., Research Fellow, Member of the LISA Lab (Laboratory in Innovative Entrepreneurship and Academic Spin-offs), University of Salerno, Fisciano, Italy. Her research interests include technology and innovation across fields and issues.

Managing Emergencies Through Resilience: The Case of Turin Smart City

Mara Grimaldi

Abstract The study explores the enabling factors of resilience as a key lever to address complexity, challenge technological evolution and foster growth in urban contexts. The goal is to explore the determinants of resilience to understand how smart cities can seize opportunities for innovation starting from disruptive event through the right combination of technology, human and social capital. Resilient smart cities can challenge environmental changes and develop proactive behaviors that encourage the attainment of social, economic and environmental well-being. Therefore, being resilient entails the redefinition of orientation, business models, technology and resource allocation to turn a crisis (such as Covid-19 pandemic) into an opportunity for development. Given the need to clarify the key determinants of resilience in contemporary cities, this article aims at exploring: (1) the main drivers for resilience to challenge a crisis; (2) how the drivers o resilience can be activated and combined to create opportunities for innovation. The empirical research is based on a content analysis that explores the case study of the Italian smart city of Turin. The results allow the identification of the determinants of resilience according to an exploratory approach, in which the smart projects and the set of technologies, resources and institutions exchanged and co-developed by Turin smart city are classified to obtain some enabling dimensions for resilience.

Keywords Service ecosystems view · Smart cities · Value co-creation · Resilience · Innovation

1 Introduction

The spread of Covid-19 forces private companies, public institutions and administration to comply with an imposed social and technological evolution (Pettit et al., 2013). The new tools introduced to challenge the limitations posed by pandemic

M. Grimaldi (✉)
Department of Business Science, Management & Innovation Systems, University of Salerno, Fisciano, Italy
e-mail: margrimaldi@unisa.it

A. Visvizi and O. Troisi (eds.), *Managing Smart Cities*,
https://doi.org/10.1007/978-3-030-93585-6_15

reframe actor's interactions by redesigning resources integration and changing the rules that guide value co-creation (Polese et al., 2020).

The uncertainty of the context requires today's companies to manage disruption by constantly pursuing a proactive attitude to turn crisis into an opportunity for growth and prosperity (Chroust & Aumayr, 2017). Hence, private and public companies in Covid-19 era should adopt systems business models capable of dealing with unexpected phenomena and of developing continuous improvement through appropriate strategies for crisis management.

For this reason, in the last decade, managerial studies focused on the study of resilience as the ability of a system to develop adaptive reactions to stress events or changes (Bhamra et al., 2011). Thus, resilience can be intended as an attitude to systems adaptation, to the constant reshaping of economic, technological and cultural practices to address the evolving needs of a changing context.

In contemporary research there is a growing attention toward the creation of resilience not only in businesses but also in smart cities, intended as complex sets of relationships between public, private and non-profit actors. There is the need to explore how smart cities can reorient their strategies and readapt their processes to comply with the mounting evolution required by disrupting events in a turbulent scenario (Ramezani & Camarinha-Matos, 2020; Kashef et al., 2021).

To investigate cities' capability to adapt and react to environmental instability, smart cities can be reinterpreted as ecosystems, and resilience can be reframed as ecosystem's ability to overcome crisis. Service ecosystems' view (Akaka et al., 2013; Vargo & Lusch, 2010) can contribute to analyse how smart cities can challenge social and economic crisis. This perspective provides a systems' understanding of how value co-creation process can benefit from disruption by giving birth to new resource integration practices that foster the co-development of innovation. The objective of this chapter is to identify the key levers for resilience that should be developed in smart cities in Covid-era to address environmental complexity, to nurture resilience and to turn crisis into an opportunity for innovation. Therefore, the study aims at addressing the following research questions:

RQ1: Which are the key ecosystem's drivers for resilience in smart cities?
RQ2: How can these drivers be combined to (co-)develop innovation in smart cities?

Through a content analysis as an inquiry, the chapter examines the key smart projects implemented in Turin, an Italian smart city, to manage Covid-19 through participatory governance, citizens' engagement and open innovation strategies. The findings of the case study allow conceptualizing the enabling factors for the development of resilience and innovation in smart cities reframed as service ecosystems. In this way, managers and policy-makers are provided with some insights that shed light on how smart cities ecosystems can become resilient by enhancing managerial flexibility to gain prosperity and encourage innovation.

2 Conceptual Background

In line with the two research questions introduced above, resilience and the key dimensions identified in extant research should be defined (Sect. 2.1) and the concept should be applied to smart cities, reinterpreted as service ecosystems (Sect. 2.2).

2.1 Resilience in Smart Cities

Over the past few decades, the emergence of global and international crises shows the importance for organizations to implement sustainable and resilient behaviors to survive unpredictable phenomena and manage unexpected external stressors. The spread of Covid-19 and the regulations and technological tools adopted by government to manage the pandemic, have accelerated and systematized the need to deal with organizational scenarios characterized by complexity and uncertainty (Seetharaman, 2020). In this context, resilience becomes one of the most investigated topics that contribute to identify the drivers for survival in a turbulent environment (Camarinha-Matos, 2014; Ramezani & Camarinha-Matos, 2020; Brodie et al., 2021). Resilience is defined as the ability of companies to endure and thrive in unpredictable scenarios (Drăgoicea et al., 2020; Russo & Ciancarini, 2017) by absorbing shocks and implementing changes to recover from those shocks (Bhamra et al., 2011).

Extant research emphasizes the need to understand the right approaches to increase the degree of resilience in the organizations that aim at surviving in times of unexpected events. Thus, resilience is studied as one of the most powerful perspectives to cope with disruptions in contemporary organizations (Ramezani & Camarinha-Matos, 2020; Brodie et al., 2021). In today's scenario, businesses are considered as integrated sets of digital technologies that invest in relationships to overcome emerging challenges through the (co-)creation of new knowledge and innovation (Gervilla et al., 2019; Polese et al., 2020). Resilience is one of the key indicators used in smart city planning to assess urban sustainability and growth. The exploration of resilience contributes to assess the degree of viability of smart cities in dealing with unforeseen events, such as natural disasters, terrorism, energy crises, and climate change. When a city is planned to be smart, it must also be prepared to be resilient (Arafah & Winarso, 2017; Desouza & Flanery, 2013; Visvizi et al., 2017). Cities are intended as complex systems in which resilience can be developed through multi-level processes (Ciasullo et al., 2020) and interactions that exceed the city's physical limits. It follows that smart city must adopt systems business models capable of dealing with events of rupture and detachment (Peters et al., 2020), in order to survive or even take the opportunity to develop in a context of volatility and uncertainty. This need has led to a growing attention towards resilience (Lengnick-Hall et al., 2011; Lorenz, 2013) and, in particular, to the analysis of resilience as a driver for smarter cities.

In the 2015 UN strategy for the Sustainable development goals (SDGs), smart cities are defined as key players in the development of inclusive urbanization and resilience (Goal 11) (cf. Visvizi & Perez del Hoyo, 2021). Cities are intended as complex systems in which resilience can be developed through multi-levelled processes (Ciasullo et al., 2020) to proactively and effectively reacting to emergency situations (Lengnick-Hall et al., 2011; Lorenz, 2013). Therefore, detecting the technological changes introduced by the Covid-19 allows to identify the enablers for the management of emergency and, thus, for the attainment of resilience. The adoption of smart technologies launched to implement the health restrictions enables the creation of new knowledge, new communication modes and practices, and eventually, innovation (Azoulay & Jones, 2020). Communication and collaboration are pivotal for the smart city sustainability, which increases, in turn safety, inclusion and resilience (Polese et al., 2020; Visvizi & Lytras, 2019). Hence, the measurement of a resilient attitude and the identification of the drivers to resist the stresses and the conditions for the post-emergency restart should be investigated.

2.2 Reinterpreting Resilient Smart Cities as Service Ecosystems: Toward Innovation

A resilient city is a city capable of proactively and effectively reacting to emergency situations and external events (economic, environmental, and health, for instance). Technology and data can help cities absorb future growth and challenge shocks by reducing the cost of gathering data through a set of smart technologies that offer real-time information (Troisi et al., 2020). Starting from the extant research on smart cities and resilience, the existing concepts and definitions of the smart city need to be redefined and complemented.

Considering the multi-layered and networked nature of urban contexts, smart cities should be reinterpreted according to a systems perspective. Thus, service ecosystems view (Akaka et al., 2013; Vargo & Lusch, 2010) seems to be an appropriate theoretical framework to shed light on the transformative role of ICT (Akaka et al., 2019; Lytras et al., 2021) in the interactions among actors in smart cities. The concept of service ecosystem (and its key dimensions such as technology, institutions, resources integration, value propositions, etc.) seems to be suitable for an in-depth investigation of resilient organizations. It allows to grasp how resilient solutions for citizens can be pursued systematically using new technologies that, by means of learning-based mechanisms and the involvement of users in decision-making, can encourage innovation (Löbler and Lusch, 2014; Troisi et al., 2017). The adoption of ecosystems view to promote resilience is explored also in smart cities research as the capability to recreate urban structure, processes and behaviours to deal with current and future hazards (Gotham & Campanella, 2010; McPhearson et al., 2015).

Service ecosystems view can help reframe smart cities as dynamic combinations of technology, people, interactions and resources that can give birth to the co-creation

of innovation and growth (Azoulay & Jones, 2020). In line with the last development in service research, service ecosystems view (Chandler & Vargo, 2011) reframes organizations as embedded systems of actors that exchange resources more easily thanks to technology. Moreover, the constant redefinition of the institutions and rules that coordinate exchanges (Vargo & Lusch 2017; Spohrer et al., 2012) enhances the co-creation of new value, new practices, innovation (Grieco & Cerruti, 2018; Hinings et al., 2018). Value co-creation is intended as a process emerging from the combination of multi-levelled transformations at micro (individual), meso (relational) and macro (institutional) levels of exchange (Vargo et al., 2015).

For this reason, resilience can be defined as a complex process through which innovation and social change are spread across cities' multi-level contexts, by enveloping economic, technological, social and cultural dimensions (Polese et al., 2020; Troisi et al., 2021; Visvizi & Lytras, 2019). Therefore, the measurement of resilient attitude and the identification of the drivers to resist the stresses and the conditions for the post-emergency restart should be investigated.

The traditional drivers identified in extant research on resilience are absorptive and adaptive capacity (Russo & Ciancarini, 2017). These are defined as systems' ability to recover from sudden shocks (Chroust et al., 2016; Dahlberg, 2015) by changing temporarily the system, which at the end of the process can recover and come back to an acceptable state (Chroust et al., 2016).

Literature on complex adaptive systems and ecosystems reframes resilience as the result of transformability capabilities (Dahlberg, 2015). Transformative resilience does not imply the conservation of existing structures after system's response to crisis, but it involves necessarily systems' ability to reorganize, reconfigure, restructure, and reinvent in response to disruptions.

Service ecosystems are defined as constantly evolving systems that renew continuously their social practices and the processes that drive the development of new knowledge and innovation (Polese et al., 2021; Vargo et al., 2017). It follows that the traditional enabling factors for co-created innovation and ecosystem's change in service ecosystems (institutions, value propositions, resource integration, technology) should be reread in the light of the search for resilience.

Hence, service ecosystems view can contribute to shed light on the drivers of resilience, intended as ecosystem's capability to renew their interactions, values and resources integrating practices to address proactively environmental changes. The overall synergy deriving from value co-creation can foster the emergence of resilience, intended as the complex result of ecosystem's restructuring, adaptation and institutionalization. Resilience can enable the transition from the resolution of emergency to the emergence of continuous improvement and innovation (Peters et al., 2020; Polese et al., 2020).

3 Methodology

To address the two research questions introduced above, the empirical research analyzes the smart projects implemented during last year by the municipality of Turin. The study collects information on the new strategies, technological tools and practices for education, mobility, sustainability realized after the advent of Covid-19. Through a content analysis as an inquiry, the key smart policies implemented in Turin to manage the pandemic are explored.

3.1 The Context of the Study

Even if the first country affected by Covid-19 was China, by April 2020 Europe has become the epicentre of the pandemic. Italy, Spain and France were the most affected European countries. On April 15, 2020, the mortality rate was 4% in China, 13% in Italy, 11% in Spain, and 15% in France (Ceylan, 2020). Therefore, it can be interesting to analyse the strategies adopted in Italy (the most affected country in Europe with the highest mortality, 4.330.739 cases and 128.010 deaths as reported by Dashboard ECDC and World Health Organization) to limit the economic and social damages produced by the pandemic.

In this scenario, the cities were at the forefront of the fight against the virus (Global Data, 2020a, b). The pandemic poses a major challenge for smart cities, but in a period of crisis and doubts, there is the awareness that digitalized cities can help addressing the limitations posed by Covid-19. Despite urban centres can favour social contacts and the spread of the virus, with more connected and intelligent cities and through digital transformation it is possible to counter the spread of the contagion. The health emergency can be considered as the testing ground for new apps and online services that contributed to enhance safety and to improve solidarity.

Turin, situated in Piedmont (Northwest Italy), is a success story of digitalization and through the use of Iot and technology solution becomes one of the most virtuous smart cities in Italy (EY Smart City Index, 2020). As shown in EY's report (2020), in Covid-era Turin is one of the most resilient cities, thanks to the coverage of latest generation telecommunication networks, the capillarity of the transport networks, the diffusion of sensors and traffic and safety control centers.

In this context, it is imperative to analyze the actual processes implemented by Turin smart city to realize good management practices and support them through ICT-enhanced solutions to address the pandemic.

3.2 Data Analysis and Collection

The study analyses the smart initiatives implemented in Turin to challenge Covid-19 through participatory governance, citizens' engagement and open innovation projects based on the collaboration between public–private and third sector. Data is collected from the official website of Turin Municipality and of specific projects launched by Turin Smart City (such as "Turin Social Impact" website, "Turin City Lab" website). Moreover, European Union and smart cities strategic documents and official statistics available on the Internet have been gathered.

The work adopts an exploratory qualitative approach based on a content analysis as inquiry (Losito, 1996). This technique allows at extracting from the texts a smaller number of categories and to detect some focal points and key concepts (Krippendorff, 2004) related to the different variables investigated through the application of semantic criteria established by the researchers.

The content analysis detects the main ecosystem's enablers implemented in Turin smart city to survive the Pandemic and develop resilience at micro, meso and macro-level (RQ1). Then, starting from the identification of the main enablers of value co-creation in the three ecosystems' contexts, the new kind of innovation generated (RQ2) are investigated. The goal is to classify some drivers that can support contemporary resilient smart cities in the management of crisis, environmental turbulence and technological and market evolutions.

Therefore, based on the key enablers of value co-creation in service ecosystems at micro, meso and macro-contexts introduced in the previous paragraph, the content analysis sketch presented in Table 1 has been designed.

To explore the first research question, the main enablers of value co-creation in service ecosystems (discussed in Sect. 2.2), reinterpreted as drivers for resilience, are employed as macro-variables that can guide content analysis. The outcomes of resilience are then investigated (DR2) to detect the new values (interaction modalities, rules, etc.) produced within Turin smart city.

The texts have been explored through complex process of semantic interpretation. The variables investigated have been sub-divided into keywords to facilitate the search for topics and sub-topics within the text, which are then further specified in some sub-dimensions for each variable. The textual units are coded independently by three researchers based on a substruction process (Dulock & Holzemer, 1991), which follows a synthesis approach that mediates between deduction (from general variables to specific keywords) and induction (from keywords to further specific sub-dimensions).

4 Results

The project Turin Social Impact was implemented by the smart city of Turin over the period 2020–2021 and consisted of an integrated set of collaborative projects.

Table 1 Variables and content analysis sketch

Variables	Content analysis sketch
RQ1: Micro-level's enablers for resilience	
– Individual's attitude – Willingness to use technology	(1) Which are the key technological tools implemented to foster individual's interactions? (2) Which are the key technologies employed to improve individual's digital skills? (3) Are the actors favourable to the use of smart technologies? (4) Which are the key technologies based on Artificial intelligence employed to improve individual's willingness to engage?
RQ1: Meso-Level's enablers for resilience	
– Resources Integration – Interactions – Actor's engagement	(1) Do the engaged actors interact with each other to exchange resources and knowledge? (2) Are actors involved in the co-design of the offering and/or in the co-development of service? (3) Which are the key technology employed to simplify the relationship between humans and computers?
RQ1: Macro-level's enablers for resilience	
– Culture – Rules and practices	(1) Which are the key technologies employed to foster the digital culture of the smart community? (2) Which are the key smart projects implemented to support the removal of barriers to digital access? (3) Are the digital culture of community and the access to technology improved after the development of the smart projects?
RQ2: Innovation	
Micro-level	– Individual skills – Willingness to adopt smart technologies – Attitude toward technology
Meso-level	– Modalities of interactions between actors – Modalities of interactions between humans and technology – Modalities for resources integration
Macro-level	– Smart culture and new digital mind-set – New rules for daily lives interactions and social connections

These initiatives aim at strengthening citizens', companies' and government's ability to react and proact to the global health emergency. Moreover, they provide support to community, not only to manage crisis but also to pursue the opportunities for growth beyond the crisis. The key smart activities realized are discussed below and are classified according to the three ecosystem's contexts: micro, meso, macro,

4.1 Micro-level: Digital Skills and Removal of Barriers to Use Technology

At micro-level, Turin smart ecosystem realized a series of project to enhance people's digital skills and willingness to use technologies, to support them in the use of technological tools and to improve their access to technology. These projects aim at engaging citizens in cities life and at providing them with training activities to use the digital tools for smart working and distance learning posed by the restrictions deriving from Covid-19.

In particular, Turin Smart City introduces "Hackability-support with technology", a platform that addresses technological issues to support people who work and study at home with the same connection due to the restrictions posed by government to challenge Covid-19. A group of volunteers gives students and workers advice on solving small and large technological problems. The platform aims at co-developing ideas, make the life of people with disabilities and caregivers easier and more accessible. The experiment seeks to improve users' digital skills through the support of volunteers designers that help people solve small and big challenges in these days of isolation.

The "ICT4Student" project is part of the plan of interventions that the University of Turin has adopted in the emergency period, especially in the field of alternative teaching. The municipality provides students with (free or on loan for use) laptops, tablets, routers and sims for connectivity, as a form of direct support in order to facilitate the use of distance learning.

Lastly "Rete Adesso" (Network Now) is an initiative aimed at helping unemployed people in particular conditions of fragility and social vulnerability, in charge of the regional network of Labour Services. The contact point offers information on the services active in the area to cope with the Covid-19 emergency. The aim is to provide accompaniment for access to public and private digital services, including: access to the Digital Solidarity Program of the Italian government, activation of the SPID (public digital identity), the search for information useful for daily life, work and study.

Hence, at micro-level, an integrated set of smart tools and initiatives is implemented to enhance the ability-propensity of citizens the use of technologies. This goal is pursued through the enrichment of their digital skills by trying to remove any possible resistance in the use of digital tools for working, learning, establishing social connections, enjoying public and private services.

4.2 Meso-level: Co-Working Spaces, Engagement and Collaboration

At meso-level, Turin smart city adopts a series of collaborative and open innovation projects that permit citizens to maintain and enhance their social connections despite

the rules of social distancing- These activities aim at establishing a common mind-set toward the accomplishment of shared goals and the adoption of a common mentality aimed at addressing the crisis. In this way, not only actors-to-actors but also human–computer interactions are boosted through a set of platforms and experiencing tools that overcome any restrictions of time and distance.

"Turin City Love" is an initiative of solidarity and open innovation that offers free resources, actions and skills to support local citizens and businesses during the Covid-19 emergency. The project introduces services in different areas with the common goal of providing utilities for a better liveability (e.g., leisure, culture, mobility). The areas of interest are: (1) education and smart working, with collaboration solutions, connectivity, tools and devices to allow remote work and study; (2) healthcare: solutions for remote monitoring and communication; (3) information and digital services: solutions for facilitating access to goods and services on a local scale; (4) training: resources for the training of public administrations, businesses and professionals.

A section in particular is dedicated to the opportunities developed within "Turin Skills City", a three-day Lab that launches a real hackathon aimed at developing local solutions to the challenges related to work in digital era. The goal is to develop lifelong learning policies to ensure the updating of skills in a constantly evolving labour market.

"Turin City Lab" (TCL) is a project aimed at creating simplified conditions for companies interested in conducting testing activities in real conditions of innovative solutions for urban living. Promoted by the City of Turin, it involves a vast network of partnership of public and private actors interested in supporting and growing the local innovation ecosystem. TCL is conceived as an "open innovation laboratory" spread over the whole area of the city. TCL allows simplified access to public spaces and assets, including intangible ones (processes, services and data). The project expands and strengthens relationships within the local innovation ecosystem, through an articulated partner system. TCL aims to involve end-users and citizens, by promoting discussion on local challenges and supporting the active participation of interested communities through "challenges" and hackathon.

"Turin Social Impact" accelerates, strengthens and promotes the projects, services, opportunities and events of all local actors who act to find solutions to the social needs of the territory. Turin Social Impact is an alliance between public and private organizations that carry out projects with a high social impact, by creating a cluster of skills, initiatives, opportunities and services. The project aims at creating common infrastructures, cooperative projects, individual partner initiatives, competitions and challenges for ideas, co-design activities, implementation of projects, contributions and funding. The partners also collaborate in a transversal programming with a twofold objective: (1) to build common infrastructures and pilot projects that strengthen the ecosystem; (2) to create a collective brand to be promoted and positioned on the global map of social impact investments.

Lastly, "TuttiConnessi" (All connected) project offers concrete support to teaching, in Covid era to allow all students at accessing easily the lessons and digital

teaching tools. The devices will be collected by volunteers and sanitized, regenerated and delivered to the families of students who demand for them. Requests will be mediated by teachers or other guarantors and managed according to priority criteria.

Thus, at meso-level, Turin Smart City realizes an integrated set of projects to deepen relationships in the network, improve social connections, interactions and experience in the city and encourage the sharing of knowledge. The use of open innovation platforms can stimulate the exchange of resources, skills, ideas and can boost not only value co-creation but also co-learning (co-created learning) according to the principles of service ecosystems view. In this way, new ways of exchanging resources and of creating new value are generated. The engagement in city's life empowers citizens by improving their lives and increasing their know-how, tacit knowledge, digital culture.

4.3 Macro-level: Community's Culture and New Social Practices

At macro-level, there are a series of projects launched to increase social inclusion, access to technology and support the community and the disadvantaged people in their fight against the pandemic. Moreover, new rules, practices and a new culture for working and living socially and digitally are established. An integrated set of smart projects for community improves not only social and economic solidarity but also the enhancement of digital attitude. In this way, the new "temporary" technologies introduced in Covid-era and the new ways to live, work and establish relationships can become accepted practices even after the crisis.

"Fooding" project aims at addressing the economic needs of the city by arranging a campaign of donations and crowdfunding to provide people with sanitary goods, in particular related to childhood and gender health (diapers, sanitary towels, detergents, baby food, etc.). This action, that addresses the response to a material need, is accompanied by an awareness-raising objective: to narrate how inequalities are structured in Italy and to draw attention to the gender component. With the donations collected, the municipality purchases goods to supplement the solidarity baskets distributed to the families in charge of the project, to give an initial response to the needs of community.

"Rete solidale" (Solidarity network) is an initiative started by Turin municipality and "The Neighborhood Houses Network". The project creates a solidarity territorial network to support and protect people in situations of personal, social and economic fragility, often linked to loneliness and the absence of family networks. The actions put into the system by the territorial network of bodies and associations are: telephone psychological support, assistance to the elderly, people with disabilities and frailty, food distribution activities, support for cultural mediation and other services. The project enhances the relationships between public institutions, third sector and profit

organizations, informal groups and with all those subjects who intend to collaborate with the Houses. The goal is to promote the comparison between experiences, methods and working tools of the various houses in constantly innovating the way they operate and respond to the new needs and desires of the Territories.

"Portineria di Comunità" (literally, Community concierge) provides free assistance to disadvantaged people in the era of Covid-19: the "gatekeepers" provide a series of services: (1) IT support; (2) Homework advice and creative workshops for children; (3) Recipes from the families of a popular cooking show ("Guess who's coming to dinner?"); (4) aesthetic body care remedies; (5) psychological support. The concierge is the place to find help for services at the post office, for shopping at the market, or computer support and to reweave relationships based on solidarity and trust. It wants to become a point of reference for the community that makes it possible to meet and exchange skills and needs.

At macro-level, the creation of a cohesive community based on solidarity and of collaboration to promote well-being and social inclusion provides the ecosystems with the opportunity to develop constantly the opportunities to promote innovation and pursue continuous improvement. The new values emerged at macro-level improve the culture of solidarity of the city, enrich the smart culture of citizens and promote new practices to address the social needs of the territory.

5 Discussion

The results of the study allow at identifying the main ecosystem's enablers of resilience and innovation implemented in Turin Smart City across the three ecosystem's contexts (micro, meso and macro). Transitioning from micro to macro level, the transformation of value across multi-layered contexts to develop innovation incrementally and to attain resilience at the end of the process can be investigated.

To address RQ1, the key actors, resources integration, technology and value propositions of Turin Smart cities have been detected and discussed.

The main *actors* engaged in Turin smart ecosystem are: (1) public institutions; (2) private companies; (3) non-profit association; (4) citizens.

The *resources integration* between people and organizations is enabled by a set of smart tools that enhances the sharing of information and knowledge among users that permits the constant connection between citizens and public institutions. Moreover, not only communication among the actors is simplified but the digital skills of individuals are boosted.

The creation of a real-time integrated system for transparent communication enhances the sharing of actor's *value propositions*. This system enhances citizens' engagement in the public space and in decision-making by involving people in the dynamics of urban government. Hence, citizens' behavior can be monitored and their attitude toward technology can be improved, by raising their willingness to use technology and to comply with the governmental guidelines dictated by the Pandemic.

The different kinds of *technology* (platforms, IoT, mobile applications, etc.) develop an integrated ecosystem that: (1) supports actors in the use of technological, by improving their access to technology and their willingness to engage (at micro-level); (2) engages citizens in cities life and decision-making by enriching their social connections and increasing actors-to-actors and human–computer interactions; (3) increases social inclusion, support the community in the fight against the pandemic and enhance digital culture.

The dynamic combination of the ecosystem's enablers for value co-creation can contribute to detect the transition from the resolution of emergency to the emergence of innovation for the (co-)development of resilience. Thus, thanks to the rereading of smart cities as service ecosystems, resilience can be reframed as s a dynamic capability that can lead to ecosystem's adaptability and transformative ability (Dahlberg, 2015). The transition from absorptive to adaptive and transformative capabilities to develop resilience can be understood through the ecosystem's ability to maintain, disrupt and change (Vargo et al., 2015) after the resolution of an unexpected phenomenon. Firstly, the ecosystem adapts to the crisis, to the use of new technologies by adjusting users' skills (maintenance at micro-level). Then, in the *disruption* phase, the existing knowledge is recombined and re-designed to give shape to new patterns of connections between actors and new interactive-communicative modalities. Lastly, Transformation at systems macro-level can *change* community's culture, the rules that guide interaction by co-creating new shared meanings and innovation.

The emergence of resilience in ecosystems can be defined as a complex process through which transformation is spread across ecosystem's contexts. Resilience is an all-encompassing process that covers individual intentions (micro-level), social networks of interactions (meso-level) and culture (macro-level). Therefore, proactiveness and transformative state in ecosystems can act as a driver for resilience.

To detect the innovation emerged in Turin smart ecosystem (RQ2), the different kind of novelties generated from the development of resilience and from the spreading of a constant innovative tension in the ecosystem have been identified. Ecosystem's adaptation (maintenance), restructuring (disruption) and transformation (change) can generate as an attitude to resilience, as the constant reshaping of culture and value propositions to address the evolving social needs through continuous co-learning process.

Hence, as Fig. 1 shows, resilience in smart ecosystems can be intended as the result of the continuous feedback among micro, meso and macro-levels and can give birth, in turn, to different kind of novelties in the three contexts:

(1) Micro-level: where new or improved skills, attitude to technology and willingness to use technology are created;
(2) Meso-level: where the modalities for actors' engagement, interactions, resources integrations and knowledge sharing are renewed according to a constant modelling of value co-creation practices;
(3) Macro-level: where the new, co-created, smart culture is spread in the ecosystem (based on social inclusion and democratic access to technology) by establishing incentives to innovate.

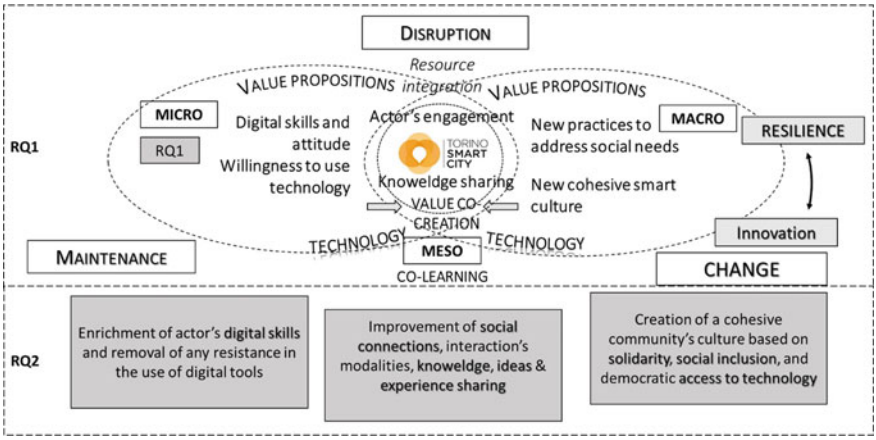

Fig. 1 The emergence of resilience and innovation in smart ecosystems. *Source* author's elaboration

The innovation (co-)developed in the ecosystem, the new attitudes (micro), relational modalities (meso) and culture (-macro) can reshape and change the ecosystem from a technological, cultural and social point of view. This innovative tension can establish a constant proactive status in which the new knowledge and social values created are "stored" as new data within the systems, re-elaborated and transformed into new rules and institutions (Siltaloppi et al., 2016; Vargo et al., 2015). Moreover, a new culture for working and living socially and digitally is established. The integrated set of smart projects arranged in Turin Smart City improves not only social and economic solidarity but also the enhancement of digital attitude. In this way, the new "temporary" technologies introduced in Covid-era and the new ways to live, work and establish relationships can become accepted practices. Therefore, challenging the emergence of crisis in ecosystems by learning to manage the appearance of new and unexpected phenomena (technologies, interaction modalities, ways of providing services, etc.) makes it possible to transform the unknown, the crisis into opportunity.

The virtuous cycle of value co-created innovation and resilience, intended as the ability to pursue social change constantly, can be reframed as an innovation-oriented mind-set refilled through renewed value co-creation and progressive enhancement of ecosystem's well-being over time. This mind-set can address complexity and changing user's needs in progress through flexible attitude to changes and co-evolution. The creation of a cohesive culture can help co-developing social capital and reframing (new) value as the result of the technology-enhanced social interactions, which are institutionalized and transformed into common social practices (Korkman, 2006; Rihova et al., 2015).

6 Concluding Remarks

Detecting the technological changes introduced by Covid-19 in the relational modalities and the interactional patterns among people mediated by technology allows at identifying the enablers for the management of emergency and, thus, for the attainment of resilience. The analysis of the best practice of Turin Smart City can help future research, students and practitioners learn from the strategies for emergency management implemented in the case analysed. Managers and urban policy-makers can identify and replace inadequate practices, raise efficiency and effectiveness by understanding how to manage disrupting events.

The sharing of Turin's best practice can provide some guidelines to identify the essential features and the drivers for the development of resilience, by increasing the knowledge on this subject and permitting experts to apply and adapt the practices analysed in a new context. The study can help management, practitioners and scholars understand: (1) how smart projects and technologies can be employed to challenge pandemic and help people comply with the economic and social limitations posed by Covid-19; (2) how ecosystem's adaptation and change can lead to the introduction of new practices that can create innovation and change durably the culture of community, the value co-creation practices and the modalities of service provision.

The identification of the enablers of resilience and innovation to challenge the global health emergency can help scholars and practitioners identify the key drivers to overcome social and economic crisis. Moreover, the exploration of how technology can redefine human–computer interactions can address a gap in literature related to the absence of studies that investigate the role of technologies in reframing social connections within a community (Lytras & Visvizi, 2018). The work can encourage theoretical developments on the classification of the different technological tools that can support the provision of education services in the different moments of service provision.

The findings of the research can help pinpoint how social, economic and health emergencies can enable the achievement of continuous transformations and changes within ecosystems by developing multiple innovation processes to be regenerated over time (Polese et al., 2020). Thus, the study can show management the main enabling factors to address crises, such as the global emergency of Covid-19, and how these elements can be harmonized to attain systems continuous re-adaptation that fosters innovation and, in turn, resilience. Further studies can start from the enablers of resilience and innovation identified in this study to create a conceptual framework to be validated through qualitative research (observation, semi-structured interviews). For instance, grounded theory based on an exploratory or constructivist approach (Charmaz, 2002) can allow researchers at exploring how the enrichment of knowledge in a system can be enhanced gradually through multiple research steps and phases of observation.

References

Akaka, M. A., Koskela-Huotari, K., & Vargo, S. L. (2019). Further advancing service science with service-dominant logic: Service ecosystems, institutions, and their implications for innovation. In *Handbook of service science* (Vol. II, pp. 641–659). Springer, Cham.

Akaka, M. A., Vargo, S. L., & Lusch, R. F. (2013). The complexity of context: A service ecosystems approach for international marketing. *Journal of International Marketing, 21*(4), 1–20.

Arafah, Y., & Winarso, H. (2017). Redefining smart city concept with resilience approach. In *IOP Conference Series: Earth and Environmental Science* (Vol. 70, No. 1, p. 012065). IOP Publishing.

Azoulay, P., & Jones, B. (2020). Beat COVID-19 through innovation. *Science, 368*(6491), 553.

Bhamra, R., Dani, S., & Burnard, K. (2011). Resilience: the concept, a literature review and future directions. *International Journal of Production Research*, *49*(18), 5375–5393.

Brodie, R. J., Ranjan, K. R., Verreynne, M. L., Jiang, Y., & Previte, J. (2021). Coronavirus crisis and health care: Learning from a service ecosystem perspective. *Journal of Service Theory and Practice.*

Camarinha-Matos, L. M. (2014). Collaborative networks: A mechanism for enterprise agility and resilience. In *Enterprise interoperability VI* (pp. 3–11). Cham: Springer.

Ceylan, Z. (2020). Estimation of COVID-19 prevalence in Italy, Spain, and France. *Science of The Total Environment*, *729*, 138817.

Chandler, J. D., & Vargo, S. L. (2011). Contextualization and value-in-context: How context frames exchange. *Marketing Theory, 11*(1), 35–49.

Charmaz, K. (2002). Qualitative interviewing and grounded theory analysis. In J. F. Gubrium & J. A. Holstein (Eds.), *Handbook of interview research: Context and method* (pp. 675–694). Sage.

Chroust, G., Kepler, J., & Finlayson, D. (2016). Anticipation and systems thinking: A key to resilient systems. In *ISSS, 60th Annual Conference and Meeting of International Society for the Systems Sciences* (Vol. 1, pp. 1–12).

Chroust, G., & Aumayr, G. (2017). Resilience 2.0: Computer-aided disaster management. *Journal of Systems Science and Systems Engineering, 26*(3), 321–335.

Ciasullo, M. V., Troisi, O., Grimaldi, M., & Leone, D. (2020). Multi-level governance for sustainable innovation in smart communities: An ecosystems approach. *International Entrepreneurship and Management Journal, 16*(4), 1167–1195.

Dahlberg, R. (2015). Resilience and complexity: Conjoining the discourses of two contested concepts. *Culture Unbound, 7*(3), 541–557.

Dahlberg, R., Johannessen-Henry, C. T., Raju, E., & Tulsiani, S. (2015). Resilience in disaster research: three versions. *Civil Engineering and Environmental Systems, 32*(1–2), 44–54.

Desouza, K. C., & Flanery, T. H. (2013). Designing, planning, and managing resilient cities: A conceptual framework. *Cities, 35*, 89–99.

Drăgoicea, M., Walletzký, L., Carrubbo, L., Badr, N. G., Toli, A. M., Romanovská, F., & Ge, M. (2020). Service design for resilience: A multi-contextual modeling perspective. *IEEE Access, 8*, 185526–185543.

Dulock, H. L., & Holzemer, W. L. (1991). Substruction: Improving the linkage from theory to method. *Nursing Science Quarterly, 4*(2), 83–87.

EY. (2020). Smart City Index 2020. Sostenibilità, Marzo 2020, Ey Advisory S.p.a. https://assets.ey.com/content/dam/ey-sites/ey-com/it_it/generic/generic-content/ey_smartcityindex_sostenibilita_marzo2020.pdf.

Gervilla, M. J. Q., Díaz-Mendez, M., & Gummesson, E. (2019). Balanced centricity and triads: Strategies to reach ecosystem equilibrium in the arts sector. *The Journal of Business and Industrial Marketing, 35*(3), 447–456.

Global Data. (2020a). *India's smart cities playing big role in technology led battle against COVID-19, says GlobalData*, https://www.globaldata.com/indias-smart-cities-playing-big-role-in-technology-led-battle-against-covid-19-says-globaldata/.

Global Data. (2020b). *UK smart cities need to advance in response to COVID-19, says GlobalData*, https://www.globaldata.com/uk-smart-cities-need-to-advance-in-response-to-covid-19-says-globaldata/.

Gotham, K. F., & Campanella, R. (2010). Toward a research agenda on transformative resilience: Challenges and opportunities for post-trauma urban ecosystems. *Critical Planning, 17*(Summer), 9–23.

Grieco, C., & Cerruti, C. (2018). Managing co-creation in innovative business models: The case of sharing economy. *Sinergie Italian Journal of Management*, *36*(May-Aug).

Hinings, B., Gegenhuber, T., & Greenwood, R. (2018). Digital innovation and transformation: An institutional perspective. *Information and Organization, 28*(1), 52–61.

Kashef, M., Visvizi, A., & Troisi, O. (2021). Smart city as a smart service system: Human-computer interaction and smart city surveillance systems. *Computers in Human Behavior*, *124*, 106923.

Korkman, O. (2006) Customer value formation in practice: A practice-theoretical approach, Svenska handelshögskolan.

Krippendorff, K. (2004). Reliability in content analysis: Some common misconceptions and recommendations. *Human Communication Research, 30*(3), 411–433.

Lengnick-Hall, C. A., Beck, T. E., & Lengnick-Hall, M. L. (2011). Developing a capacity for organizational resilience through strategic human resource management. *Human Resource Management Review, 21*(3), 243–255.

Löbler, H., & Lusch, R. F. (2014). Signs and practices as resources in IT-related service innovation. *Service Science, 6*(3), 190–205.

Lorenz, D. F. (2013). The diversity of resilience: Contributions from a social science perspective. *Natural Hazards, 67*(1), 7–24.

Losito, G. (1996). *L'analisi del contenuto nella ricerca sociale* (Vol. 1). FrancoAngeli, Milano.

Lytras, M. D., & Visvizi, A. (2018). Who uses smart city services and what to make of it: Toward interdisciplinary smart cities research. *Sustainability, 2018*(10), 1998. https://doi.org/10.3390/su10061998

Lytras, M.D., Visvizi, A., Chopdar, P.K., Sarirete, A., & Alhalabi, W. (2021). Information management in smart cities: Turning end users' views into multi-item scale development, validation, and policy-making recommendations. *International Journal of Information Management*. 56, 102146. https://doi.org/10.1016/j.ijinfomgt.2020.102146.

McPhearson, T., Andersson, E., Elmqvist, T., & Frantzeskaki, N. (2015). Resilience of and through urban ecosystem services. *Ecosystem Services*, *12*, 152–156; Karvonen, A., Cugurullo, F., & Caprotti, F. (Eds.). (2018). *Inside smart cities: Place, politics and urban innovation*. London, UK: Routledge.

Peters, L. D., Nenonen, S., Polese, F., Frow, P., & Payne, A. (2020). Viability mechanisms in market systems: Prerequisites for market shaping. *Journal of Business & Industrial Marketing., 35*(9), 1403–1412.

Pettit, T. J., Croxton, K. L., & Fiksel, J. (2013). Ensuring supply chain resilience: Development and implementation of an assessment tool. *Journal of Business Logistics, 34*(1), 46–76.

Polese, F., Payne, A., Frow, P., Sarno, D., & Nenonen, S. (2021). Emergence and phase transitions in service ecosystems. *Journal of Business Research, 127*, 25–34.

Polese, F., Troisi, O., Grimaldi, M., & Sirianni, C. (2020). *Conceptualizing social change, between value co-creation and ecosystems innovation* (p. 203). Festschrift für Universitätsprofessor Dr. Dr. hc Helge Löbler.

Ramezani, J., & Camarinha-Matos, L. M. (2020). Approaches for resilience and antifragility in collaborative business ecosystems. Technological forecasting and social change, 151, 119846; Baron, M. (2012). Do we need smart cities for resilience. *Journal of Economics & Management, 10*, 32–46.

Rihova, I., Buhalis, D., Moital, M., & Gouthro, M. B. (2015). Conceptualising customer-to-customer value co-creation in tourism. *International Journal of Tourism Research, 17*(4), 356–363.

Russo, D., & Ciancarini, P. (2017). Towards antifragile software architectures. *Procedia Computer Science, 109*, 929–934.

Seetharaman, P. (2020). Business models shifts: Impact of Covid-19. *International Journal of Information Management*, *54*, 102173.
Siltaloppi, J., Koskela-Huotari, K., & Vargo, S. L. (2016). Institutional complexity as a driver for innovation in service ecosystems. *Service Science, 8*(3), 333–343.
Spohrer, J., Piciocchi, P., & Bassano, C. (2012). Three frameworks for service research: Exploring multilevel governance in nested, networked systems. *Service Science, 4*(2), 147–160.
Troisi, O., Maione, G., Grimaldi, M., & Loia, F. (2020). Growth hacking: Insights on data-driven decision-making from three firms. *Industrial Marketing Management, 90*, 538–557.
Troisi, O., Sirianni, C. A., Monda, A., & Grimaldi, M. (2017). ICTS and engagement platforms in resource integration: Threat or opportunity for value co-creation? *Esperienze D'impresa*, *5*(1), 99–123.
Troisi, O., Visvizi, A., & Grimaldi, M. (2021). The different shades of innovation emergence in smart service systems: the case of Italian cluster for aerospace technology. *Journal of Business & Industrial Marketing*, ahead-of-print No. ahead-of-print. https://doi.org/10.1108/JBIM-02-2020-0091.
Vargo, S. L., & Lusch, R. F. (2010). From repeat patronage to value co-creation in service ecosystems: A transcending conceptualization of relationship. *Journal of Business Market Management, 4*(4), 169–179.
Vargo, S. L., & Lusch, R. F. (2017). Service-dominant logic 2025. *International Journal of Research in Marketing, 34*(1), 46–67.
Vargo, S. L., Koskela-Huotari, K., Baron, S., Edvardsson, B., Reynoso, J., & Colurcio, M. (2017). A systems perspective on markets–Toward a research agenda. *Journal of Business Research, 79*, 260–268.
Vargo, S. L., Wieland, H., & Akaka, M. A. (2015). Innovation through institutionalization: A service ecosystems perspective. *Industrial Marketing Management, 44*, 63–72.
Visvizi, A., Mazzucelli, C., & Lytras, M. (2017). Irregular migratory flows: Towards an ICTs' enabled integrated framework for resilient urban systems. *Journal of Science and Technology Policy Management, 8*(2), 227–242. https://doi.org/10.1108/JSTPM-05-2017-0020
Visvizi, A., & Lytras, M. (Eds.). (2019). *Smart cities: Issues and challenges: Mapping political, social and economic risks and threats*. Elsevier.
Visvizi, A., & Perez del Hoyo, R. (eds). (2021). *Smart cities and the UN SDGs*. Elsevier, 9780323851510, https://www.elsevier.com/books/smart-cities-and-the-un-sdgs/visvizi/978-0-323-85151-0.

Mara Grimaldi Ph.D., Research Fellow in Business Management, University of Salerno, Fisciano, Italy. Her main areas of interest are services marketing and management, information and knowledge management, strategic innovation management.

Circular Practices with a Public Driven Local Development Processes

Giuseppe Roccasalva

Abstract Even though it is not a recent concept, Circular Economy (CE) is nowaday on the main stream of European policies and it is widely discussed on scientific literature. Overall, it seems to be a practice oriented development idea that is learning, inductively, from its practices. With some critical interpretations based on the inventory of practices, the article try to shed lights on main features for addressing development processes. Limitations, type of strategies, alternative impacts, role of stakeholder and scales of implementation must be taken into account once circular solutions want to be designed and introduced in a territory. It is argued that most effective CE developments are driven by practices and led mainly by public authorities. In this regard, it is breifly introduced two research experiences that have envisioned circular practices with a design thinking approach.

Keywords Circular economy and open innovation · Design thinking · Co-design processes · Energy efficiency and waste material flow

1 Introduction

In 2017 the European Commission has framed the theme of waste management, landfills, recycling and reuse, encouraging a shift to the circular economy paradigm.[1] Today, many research and innovation projects dealing with low-carbon, climate resilient future, in support of the European Green Deal calls, are proposing strategies

[1] European Parliamentary Research Service (EPRS) Scientific Foresight Unit (STOA) (2017).

G. Roccasalva (✉)
Department of Architecture and Design (DAD), Polytechnic of Turin, 10125, Viale Pier Andrea Mattioli, 39 Turin, Italy
e-mail: giuseppe.roccasalva@polito.it

A. Visvizi and O. Troisi (eds.), *Managing Smart Cities*,
https://doi.org/10.1007/978-3-030-93585-6_16

for Circular economy (CE). It is recognized[2] that CE provide leverages calculated in 600 billion Euros benefits annually for European manufacturing sector, in 48% reduction of CO_2 emissions and two million additional jobs until 2030 in the European Union. The attention on cyclical systems is also one of the main stream of different disciplines and scientific discussions but it is not a brand new topic. In 1966, the concept of circular economy was already outlined by the ecological economist Boulding[3] as a closed system with almost no exchanges with the environment. Pearce and Turner[4] discussed the shift from the traditional linear open-ended economy to the circular one. In 1971, among the key contributions, Georgescu Roegen[5] brought the economic domain in close contact with ecology, making a famous correlation between the economic processes and the second law of thermodynamic. In this regards, it was stated that human being processes are irreversible because material flows, as well as energy, are subjected to entropy and consequently to irrevocable dissipation. The speed of this dissipation should be the limit of human consumption and circular solutions can be the strategies for respecting the reproduction rates of material/energy usage.

The article will interpret and discuss strategically CE practices recognized and differently classified by scientific literature in order to possibly shed lights on a local applied research experiments carried out in two territorial clusters of Piedmont Region (Italy). It will be argued that most effective CE developments are driven by practices and led mainly by public authorities. In this regard, it is questioned the specific role of public authorities and the organizational domain of CE initiatives (vertical top down or incremental horizontal). Next, the cases studied will presented along with the envisioned pilot CE solutions. Finally some main questions will be posed for addressing further researches.

2 Discussing Main Practices of CE and Their Features

Comprehensive studies of scientific literature[6] on CE reported mainly practices, which imply that theoretical models and principles has grown mostly from inductive studies rather than from principles. In this sense, CE cannot be interpreted as systematic methodology but rather an ongoing learning process which can be discussed and exploited starting from its experiments. Moreover, among these practices, it was distinguished three scales of interventions that we can define as follow:

---

[2] CIRAIG (2015).
COM (2014).
COM (2015).
Ellen MacArthur Foundation (2015).

[3] Boulding (1966).

[4] Pearce and Turner (1989).

[5] Georgescu-Roegen (1971).

[6] Korhonena, Honkasalob, and Seppäläc (2017).

- local scale practices (mainly led by single companies or consumer experiments)
- clustered scale practices (mainly made by single and localized experiments as eco-industrial/symbiotic parks)
- public scale practices (which imply economic/incentive-led initiatives at local/regional/national level).

Most of these experiences (from collaborative consumption, to public procurement programs, to zero waste visions) hand over to public authorities the start up or the implementation phase of CE, revealing that almost at all scales of practices it is required the presence of more than one stakeholder, especially the public one (group of citizens/communities). The geographical distribution of these practices shows that China is discussed on the largest number of published scientific articles, probably because it was the first country in the world adopting a law for the circular economy in 2008.

In another recent comprehensive scientific study,[7] 300 practices of 83 cities were classified by the nature of their practical experiences. In this case, it is interesting to point out that the largest part of the practices were pertaining structural changes in waste flows (e.g. collection-treatment but also green constructions/materials) and in energy management (e.g. reduce, reuse, renew but also green mobility). Other two, much smaller, groups of practices were related to people's consumptions (e.g. repair of waste products, food waste and reduction of disposable products) and to other privately led practices (e.g. new efficient production for industries, energy efficiency…). A very small amount of CE practices were related to urban planning policies (mainly for new land use plans, environmental protection policies and climate friendly districts).

In a focused interpretation of these data, practices related to waste flow management (WFM) seems to be the most popular, counted nearly in 49% of all the groups of practices. Among the WFM practices, it can be counted:

- 20% which are about waste related to people's consumption as, for instance, second hand markets, repair of home devises and electronics, reuse-sharing-reduction or home composting of food waste and reduction of disposable products (prevent junk advertisements, chose disposable packaging or multiple use shopping bags, coffee cups, water containers);
- 12% which are most classical CE practices (eg. door to door waste collection, separate waste collection of e-waste, bulky, hazardous waste and waste treatment facilities);
- 9% which are about reuse and recycle of waste materials (e.g. building demolition waste or recycled asphalt);
- 8% which are about waste material in industrial processes or business experiences (e.g. using recycled and closed loop material flows, reuse of waste cascading, reduce of packaging…);

[7] Petit and Leipold (2018).

Another interesting point to deduce from the mentioned analysis on CE practices, is the size of population living on the territories involved by circular practices. Despite the density of the population that each territory might have, it is possible to make a rough distinction between CE practices which were implemented at a "small" scale of population (under 250.000 inhabitants) and those ones which took place at a "large" scale (with higher population). In general, it seems that all the aforementioned practices, no matter how they are driven or which is the final objectives, were implemented on a very large scale of territories (over 500.000 inhabitants).

In this interpretation, the WFM practices which require the involvement of people (e.g. new management systems or services, campaigns for ecological consumption, purchasing choices, and other direct or indirect citizen-dependent strategies), are almost half of surveyed practices; these are, to our concern, the inventory of the current most effective examples and implementation models in CE scientific literature. In this sense, citizens and communities are the implementation engine or the irreplaceable element for introducing CE in a new territory at all scale with a public driven support.

Finally, if we focus only on the initiatives which are directly or indirectly related to citizen's choices and to the WFM previously pointed out (49% of the total), it is possible to deduce the following interpretations regarding the size of population were these practices took place:

- CE solutions dealing with efficient waste management, with the use of recycled material in building constructions, with reuse-repair-sharing-reduction of waste and with reduction of disposable products, were experienced at almost all scales, from the small (lower than 20.000 inhabitants) to the scale over 5 million of inhabitants
- There are not yet solutions which exploit how to reuse waste material in buildings construction at a scale lower than 20.000 inhabitants.

These interpretations cannot inductively be taken as rules but they can shed some lights on pilot implementation processes, being aware which are the most frequent and successful solutions, which are the leading or core stakeholders within different size of population a scale of development process (from local to national).

3 Discussing the Role of Public Stakeholders in CE Developments

With the large CE solutions described in literature, "what" to do is rather a minor issue than "how" to implement it and "who" has to manage it. This imply the importance of designing a process that encompass the role and connections of stakeholders, the innovative impacts of the implementation processes. According to Future Design Thinking methodologies, CE implementation can be referred as a non predictable, nor controllable cause and effect process but it is an incremental trials and errors approach

that someone has to start and coordinate. So far, at local level, no public or private entity is fully charged to overlook and connect CE solutions and possible developers. Initiatives occurs often on a volunteer base, with a blended approach (horizontal/vertical), especially when it comes to design a collective transition towards innovation which rely on stakeholder's involvement. The belief is that there are several general aptness of specific groups of stakeholders which differs local communities from local public authorities and local private business/industries. At the local scale, we all are confident that no single entity can address on its own CE challenges and it is needed to search and align opportunities and to consequently design a common vision. This consideration could be exploited by national Governaments in the implementation of next generation eu funds.

In general, a public leadership is adapt, more than others, to overcome limitations of some CE. For instance, in a CE development, environmental benefits often do not have a direct value even though they have an understandable utility for the local communities. This requires the intervention of public authorities to internalize environmental externalities into policies or regulations or voluntary instruments which facilitate the development of a CE solution.[8] Also, when low profitability or lack of startup capitals and high risks are the main barriers of CE development, a public authorities can generally absolve a strategic role in providing incentives or subsides or facilitate a connection services with investors.

Local private business/industries can have a direct leadership in implementing all the profitable CE solution (from energy saving to reduced costs/time in production or the exploitation of new markets) but it is important to remind that the environmental and economic benefits of CE tend to decrease until a cutoff point[9] because the recycling of products and energy cannot turn to raw material forever (entropy law). In this regard, it is questionable how the role of time influence the leadership in CE implementation. In general, if economic/environmental depreciations of a CE solution has a very short timeframe (normally the tendency should be of medium or long term for being really sustainable), the industrial-business leadership could be more interested than public investors which are usually more patient. Materials with low entropy (minerals, hydrocarbons, unpolluted water/air, fertile land and so on) should be the first target of CE and the time of depreciation a mayor concern. However, some of this material are public goods and can have some frictions with a private stakeholder management because they must be—by definition—non rivalry in consumption.

The role of public authorities and local communities could be decisive in some CE development. This group of stakeholder, either in structured groups (municiplaities linked by an agreement/contract or linked by associated services…), semi structured groups (associations, students, consumers…) or atomized/diffused group of single persons, can be directly involved by managerial choices of waste in different phases of their flows (reduce, reuse and recycle). They can also influence the market with their purchasing choices or with public procurement. Despite, the behavioral models

[8] Andersen (2007)

[9] Daly (1977).

of local communities and public administration can change often and are loosely predictable but the transformation impact is powerful and lasting.

The author's research experience at Polytechnic of Turin has mostly focused on design thinking methods and community led developments. All over the last 17 years of applied researches and collaboration with public authorities and communities, it was experienced that local municipalities have the capacity to encourage and facilitate sustainable developments either with vertical top down driven organization or enabling incremental horizontal processes. In this regard, an important premises to a possible CE development, is to set a learning process which can frame the complex relation between CE main solutions and stakeholders main values/limits. The specific role of public authorities and communities, the organizational domain of CE initiatives must be investigated in advanced and some models of implementation envisaged.

4 Cases Studies: The Projects P3ST and Eco3R

CE practices are connected to multiple SDGs (6 on sustainable energy, 8 on economic growth, 11 on sustainable cities, 12 on sustainable consumption and production, 13 on climate change, 14 on oceans, and 15 on life on land). If we consider CE as an alternative development model compared with the traditional linear unsustainable one (extract-produce-use-dump flow model), we can point out two main strand of objectives:

- recovery energy: meant as utilize RES, solar, wind, sea, biomass and waste-derived energies throughout the product value chain or for reducing energy consumption which is not climate neutral (form mobility to building HCV systems)
- recycling materials and products: meant as reducing material source production (remanufacturing, better production), reusing, refurbishment, repair, lending, sharing and so on.

In this simple twofold objectives, two research processes were conducted (one of this is still ongoing), addressing strategies for energy-efficient and for low impact waste flows management. The processes were both developed in Piedmont Region (Italy), in two clustered territories within the Metropolitan area of Turin and within the province of Asti. The first research process (ongoing) is led by a project named Eco3R (Ecosystem for Reduce Reuse Recycle and Circular Economy) involving 19 municipalities while the second, named P3ST (Sustainable Strategic Plan for the local Territories) was approved in 2018 and involved 18 municipalities (Fig. 1).

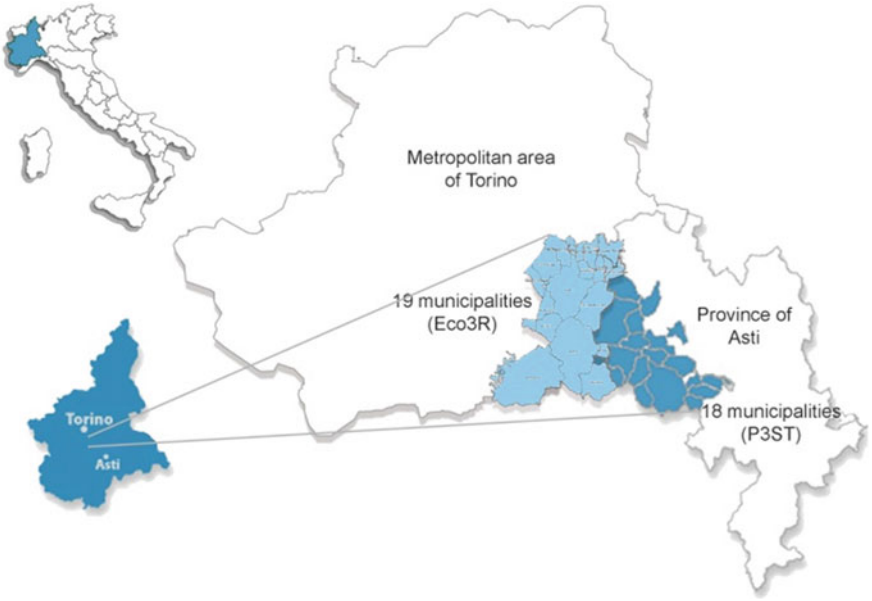

Fig. 1 The 37 municipalities (more than 150.000 inhabitants), involved by the two development research processes (*Source* own)

5 Eco3R Process

In June 2020, Polytechnic of Turin (DAD) starts collaborating with 19 municipalities in the south-east of Turin in order to introduce CE concepts and envisioning possible practices. The Municipalities work already as a territorial cluster because of their shared public service company named Consorzio Chierese per i Servizi (CSS), which provides the waste management services for about 125.647 inhabitants distribute on a total area of 434 km^2.

In collaboration with CCS, Polytechnic of Turin (DAD) has draft a concept of CE named Eco3R (Ecosystem for Reduce Reuse Recycle and Circular Economy) that was shared and discussed in July with all the Mayors and it was elaborated and submitted in December to a call for funding. In January 2021, Eco3R has received a starting grant of nearly 173.000 Euros from public authorities for implementing CE practices within one year. This fund will be used for building an experimental space (Eco3R Lab) and for learning, analyzing and co-designing CE with the stakeholders of the local ecosystem. This space will be settled in the main recycling center of the territorial cluster (head quarter of CCS) and is meant to become a showcase for pilot innovative recycling practices of different material flows with value chains. Polytechnic of Turin will also exploit this space with learning/dialogic initiatives that aims to listen and engage businesses, public officials, innovation investors, NGOs, academics, designers, citizens, industries and practitioners from the local cluster in

order to foresee potential ecosystem relations and explore strategies for reducing the quantity of materials flowing to the waste collection systems.

In the preliminary research activities, the Eco3R has envisioned two potential type of CE practices which can be led by local public authorities together with CSS. These are just initial concepts and need to be still discussed, analysed and confirmed within the project proceedings. The preliminary ideas mainly focused on enable energy-efficiency solutions and on reduceing the impact of material flows.

6 Practices for Enabling Energy Efficient Collective Solutions

The CCS territorial cluster, as most populated parts of the metropolitan area of Turin, is facing severe air quality problems with consistent exceeding amount of PM10 and NO2 air quality limits. Together with a sustainable mobility practices, public authorities are constantly looking for new and innovative clean energy practices that are the main factor for reducing the impact of the air pollutions. At the scale of the metropolitan area (higher public institution) some coordination top-down plans on these topics are already approved (District Heating Development Plan, Air quality action plan, Sustainable Energy Action Plan, Energy Guideline for Municipal Building Regulation). Instead, the public authorities of the CSS cluster could work with more horizontal actions aiming to enable citizen participating in energy actions for becoming active part of the local eco-system. In this sense, a first type of Eco3R actions could focus on promoting RES with a strong civic involvement (energy efficient collective solutions). A specific territory will be selected to build a renewable energy system (for instance a Solar Park) and promoting citizens participation with a crowd-founding approach. The same approach can be replicated on public building's roofs instead of open land or to the wide roof spaces of clustered industrial districts (which were already mapped by Eco3R project). Citizens will be able to fund single kWp of PV panels and receive profits as if they have installed it on their roofs. This mechanism will enable citizens to take advantage of the economies of scale (reduced start up cost, a more effective energy production) and to be directly responsible/aware of the environmental externalities. According to the type of space where the system will be implemented and the stakeholders involved (public/private), municipalities must design a public tender or choose to have 3P (public-private partnership) approach which make the whole business - or part of it - be financed with the crowd funding mechanism. The funding options for people will range from direct economic contributions to several small symbolic sum of money which will only get a kind of support certification (green energy supporter, labels for supporters, gratitude mail and so on...). Also, the same approach can be applied to other renewable energy sources (biomass, bio fuel, integrated models) if the solar energy is not the most suitable technological solution for the available context and required energy demand (Fig. 2).

Fig. 2 Visual samples displaying the ideas of energy efficient collective solutions, produced for an ongoing EU project proposal (*Source* own)

Together with the crowd funding approach, also Open Innovation practices could maximize the citizens investments in energy efficiency. For example, lots of new interactive media (mooc, etwinnig) can be adapted to obtain a major involvement of local communities. Public campaigns, workshops at Eco3R Lab could bring citizens closer to the benefits of some energy efficient technologies and facilitate their adoption. In this regard, Eco3R has envisaged to develop with media partners workshops and focus meetings for addressing groups of local citizens, groups of public employee, practitioners or company employee in order to simply transfer knowledge and capacity building. Another example of open innovation that Eco3R has envisaged is the aggregation of citizens inside a local virtual community; this allows citizen to participate in ancillary services market, traditionally reserved for suppliers. For example, some anonym aggregated information of the citizens (energy consumption, mobility habits, comfort preferences…) can be used by energy companies to offer better services to them and by citizens to earn some extra money. There exist technologies (eg. block chain) which could allow companies/user to buy/sell this kind of data in non-sensible or personal nature with the appropriate licenses. Citizens, companies and municipality can feed this market and provide digital information to third parties for data analyses, for user-driven personalized information and recommendations. The aggregated added value of local information could be either free of charge or rewarded with flexible pricing models. This open innovation could foster new opportunities for the energy value chain, as reducing prices with a more competitive energy market, speed up the stability of renewable system, facilitates the deployment of distributed energy resources and let end-users play an active role in energy market (Fig. 3).

7 Practices for Low Impact Waste Flow Management

The CCS territorial cluster of 19 municipalities has a door-to-door waste management service with the highest rate of recycling (over 82% on 2021) of the whole Region (which is only around 60% average), and is also among the highest in the whole country (Italy has an average below 50%). Nowadays in the whole Region we can count on wide geo-localized statistics of waste production and recycling of waste

Fig. 3 Visual samples displaying the ideas of open innovation energy solutions as the "internet of energy", produced for an ongoing EU project proposal (*Source* own)

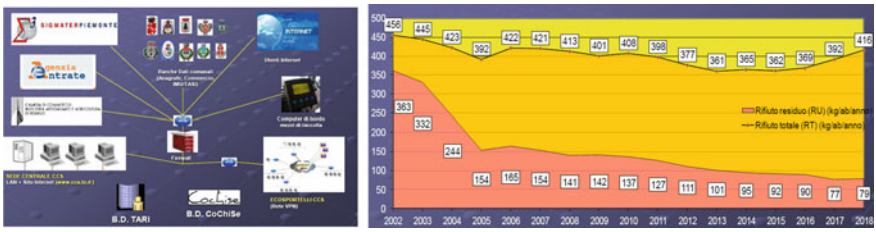

Fig. 4 The back office monitoring system combining trash cans data with public authorities dataset (left). The volume of waste collaction (upper line of diagram) and leftover volume after recycling (lower line of diagram) of the CCS clustered territories (right) (*Source* CSS)

materials while in the CCS cluster it is also possible to have a real time monitoring system as all garbage cans are equipped with devices whose data are also connected with public back office and dataset control system. Since the adoption of the door-to-door and on-time waste pricing (2005) the volume of households waste production kept being constant while the recycling rate had nearly doubled its volume (Fig. 4).

In average, inhabitants of CCS clustered territories produce 416 kg/person per year of total waste, which cost 141 euros/inhabitants/year. These results have almost reached the goals that the whole Region has set for the year 2030.

However, the statistics do not systematically report the local quantity of reuses, remanufacturing and refurbishment products/material and their values. In the case study, the recycling system is very efficient but some material flow have better revenue than other. For example, plastic and metal based materials have 80% of total costs back in revenues while glass based material have 40% and paper or cardboard based materials have 30%. In this sense, the established material flow of the local system reveals that it is more profitable the recycling of plastic and metal. In general, plastic is often perceived as disposable material and recycled for just 10% of the total amount produced. In the CCS clustered, the initial focus went on reusing plastic toys whose end of waste is not yet framed clearly by the law. This kind of objects together with other plastic material can be sorted and turned into new things. Plastic is a versatile material that can easily be recycled and turned into a semi raw material with low

Fig. 5 Images from the precious plastic project that instructed the first equipments of the Eco3R lab

temperatures and pressures. In this sense, Eco3R has envisaged to explore the possibility to have a small scale plastic workshop equipped with easy to use machinery for recycling plastic,[10] based on general industrial techniques, but designed to be managed by the final users. The machines are based on a online and open source design solution which is improved by the community of users. This kind of process imply the use of open innovation and *distributed design* methodology which aims to link networks of people with distributed design elements in order to move knowledge rather than just products. Under this approach, individuals can have access to digital information that allow them to design, produce and fabricate recycling machinery and build new products by themselves and start their own recycling workshop.

In this sense, Eco3R project could aim to start a circular and iterative process which involve the local communities with different roles, from collecting till shredding and manufacturing recycled plastic products (Fig. 5).

Eco3R is also investigating about the local waste management (WMF) with a specific mindset. The research project is trying to distinguish between three variables that are—to our concern—important in a local CE process development: the strategies (direct or indirect) that are aiming at managing waste (in terms of quantity or impact) coming from two different providers (local producers and local consumers). As Table 1 shows, the combination between this three variables can vary and this distinction is important to design the most effective CE development in relation to the objectives, the stakeholders and the environmental implications. Within this design thinking approach, the value chain investigation is not the first—too often the only one—variable to be tacked and economic exploitation is just part of the CE development variables. In this sense, Eco3R research process could firstly map industries/businesses and attitude of consumers/citizens in order to foresee potential tailored CE services or products to develop with direct or indirect strategies (e.g. creative recycling of local waste, eco-desing of local production).

The first idea of the Eco3R lab was focusing on recycling plastic for creative products but the proceedings of the research project could extend this strategy also to other waste material flows in order to expand the identity of the recycling center

[10] For this initial recycling workshop, Eco3R adopted the shared technology promoted by Precious Plastic that involve local plastic communities of recyclers since from 2014 and partners as United Nations Environment Programme in Kenya, Parley for the Oceans in the Maldives and Grameen Telecom in Bangladesh.

Table 1 Management matrix for developing solutions on waste material flow (*Source* own)

Waste providers	Strategies		Direct actions on WMF	Indirect action on WMF
	Decrease quantity of waste	Low impact		
Industries/businesses		Modular production		X
		Durable production		X
	Versatile production	Versatile production	X	X
Consumers/communities	Repair		X	
	Reuse		X	
		Refurbished	X	X
	Recycling		X	X
	Sharing	Sharing	X	X
		Lending		X

to a new experimental spatial model where end of waste is turned into a part of the ecosystem and will possibly reach even higher percentage of recycled materials or induce collective strategies for reducing wastes materials. In this regard, the local productive system was already mapped, showing the presence of interesting local production processes about cardboard recycling, natural cosmetics, bio-bricks, remanufacturing of trophy components, natural oils and so on. Other interesting material flows in the local production system have shown potential connection of flows regarding agricultural and natural productions which count special renowned vegetables and fruits but also from the local lakes with fish farming. In the coming years these local productive experiences will be gathered and enabled to foresee possible circular collaborations.

8 P3ST Project

Another research experience was carried out with the public company Acquedotto della Piana S.p.A (AP), that is managing the water supply services for a group of 18 municipalities in the province of Asti (Italy). AP is responsible of an integrated service (collection, supply and distribution of water, sewerage and purification of waste water), as well as the design, construction, management, maintenance of the related service infrastructure and buildings. AP manages a territory of about 285 km^2, with 36.126 inhabitants, distributing 2.400.000 m^3 of drinking water.

In 2015, AP has inserted in its industrial plan the following objectives:

- reduce the energy consumption

- exploring the use of RES
- make the infrastructure and the system more efficient and improve building mantainance
- improve the hydrogeology knowledge and explore sustainable activities.

AP requested a research collaboration in order to design a strategic vision that could match some of these objectives of the industrial plan in a comprehensive development process to share with the public authorities of the territory.

In two years, all the 18 municipalities were involved as one single public stakeholder in a dialogic process which has listened to their expectations and gathered information and data about their ongoing sustainable projects, their present environmental constrains/hazards and potentials. The initial meetings explored the aptness to join the European Mayor Adapt program and adopt a Sustainable Energy Action Plan (SEAP). In this regards, the AP represented the best platform for implementing a circular thinking because, as shared public company providing a basic service for the local communities, it channeled all the stakeholders to search towards common solutions.

After two years, a strategic co-designed programme (named P3ST) was delivered; it provided a framework of information and technical solutions for the two following objectives:

- improving energy efficiency of AP reducing energy consumption and investing in RES
- exploiting the environmental assets of the territory with a circular approach.

Regarding the first objective, an Energy Audit (UNI CEI EN 16,247) was carried for the company according to the Italian law (D.Lgs.102/2014). It has provided an informative framework and a cost benefit analysis on present and potential energy consumptions and reduction strategies. AP manages 159 structures (wells, reservoirs, recovery stations, drinking water treatment plants, sewage lifting stations, purifiers, warehouses) included in 80 sites. The diagnosis focuses on 20 representative sites that make up 87% of the company's total consumption. The analyses allow to draw a true and fair view of the company's overall energy performance, highlighting the tendencies (decreasing) of the previous three years. AP consumes 4.394 GWh in 2014, equivalent to 833 Tons Equivalent of Petrol, divided mainly in adduction activities (aqueduct 72%), water treatment activities (purification 27%) and discharges activities (sewage 0.5%).

Moreover, the analysis suggested a priority investment on photovoltaic systems on buildings or areas of relevance for an estimated total—within the 20 sites—of 586 kWp, which is 672.000 kWh/year, able to cover 41.5% of the energy consumed on site and to save 114.000 €/year. Considering an investment cost of 683.000 €, the pay back time of interventions is about 6.7 years on average. Other optional strategies were envisioned. The production of energy from biomasses with pyro-gasification technologies (no direct combustion, contained emissions) that can give back till 20 kW electric and 42 kW thermal. It was also envision a possible network

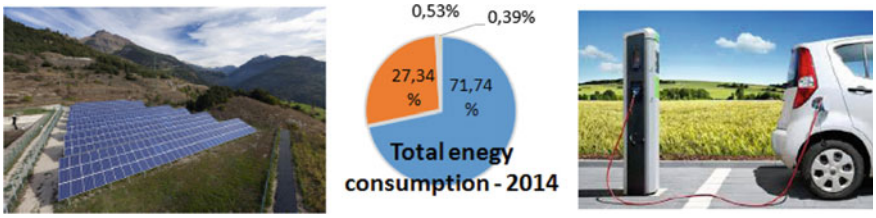

Fig. 6 Visual samples of main suggestions on energy efficiency, production of renewable and their potential usage

of charging infrastructure directly managed by AP, in connection with eco-tourism (Fig. 6).

A second objective of P3ST aimed at a comprehensive display of the main territorial qualities of the territory linked by AP. It was provided a geographic dashboard of information on environmental constrains, on cultural heritage within the 18 municipalities together with the survey of all AP infrastructures and the buildings inventory. This work assemble on a visual geographic framework all the repository of data, properties and most of territorial potentials/limits. It is important to highlight that part of this territory obtained the Unesco label for the unique agricultural landscape (Fig. 7).

A strategic and creative management of these integrated geographic information lead to the suggestion to exploit the unused water towers networks as pilot investments in the domain of eco-tourism. After a benchmark of reference cases around the world, a network of water towers was depicted in a map together with a draft design solutions for its new functions (Fig. 8).

The P3ST, officially adopted by all the municipalities in march 2018, has also made a scouting for financial and fund procurement opportunities (with local/regional and national funds, with private/public investment protocols or with European funds) in order to facilitate the implementation of the shared suggestions and strategic solutions.

9 Conclusions

The scientific debate has assigned to CE a very strategic role for our future environment. From the analyses of main literature on CE, some deductions and critical arguments were pointed out. Concepts and principles of CE come from very practical experiences whose main positive effects are more monitored rather than planned. These experimental practices are giving hints about the role/size/limits of stakeholders involved, the organizational domain of the implementation and the key characteristics to enable the shift towards a circular economy. Investors/government and European funds have already showed that CE strategies are economically appealing. Most of these development process that want to introduce CE concepts are focusing

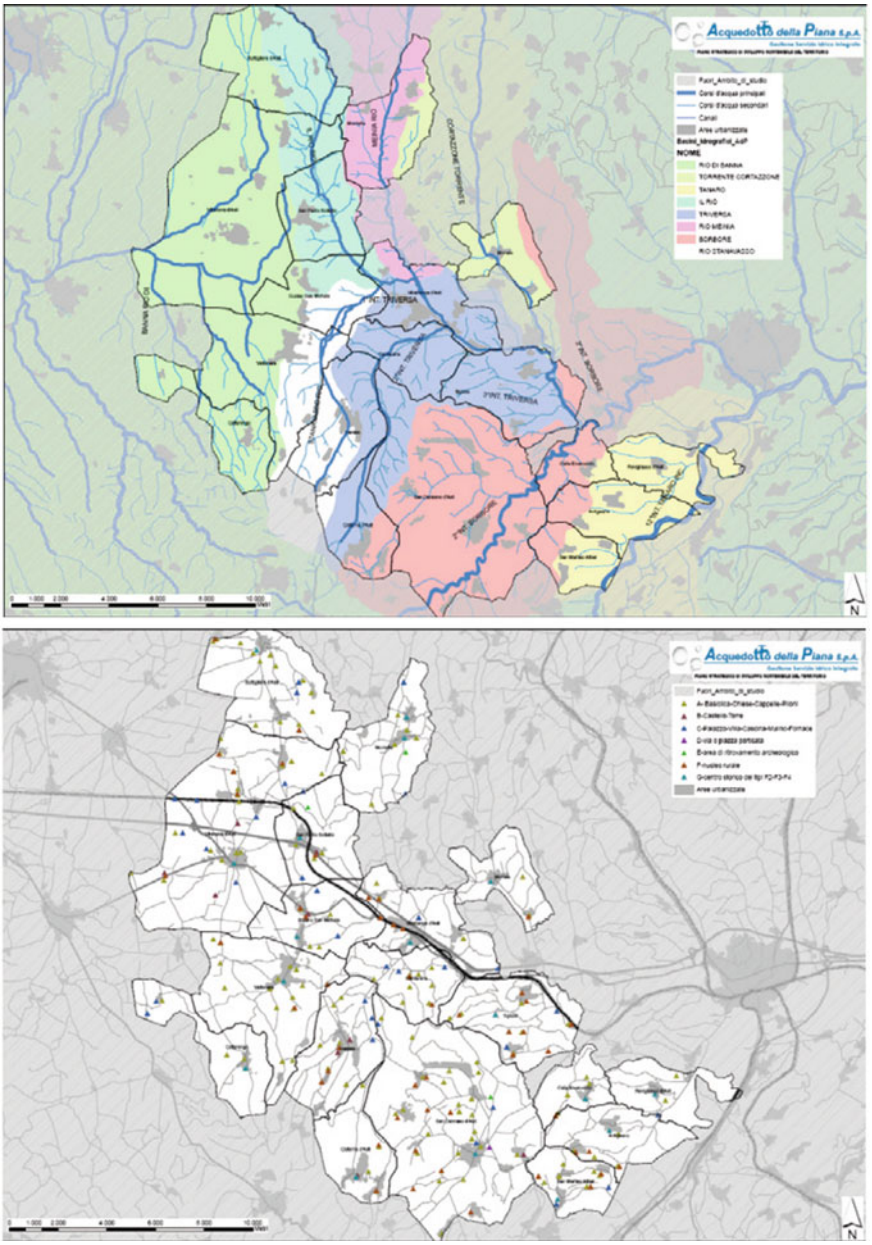

Fig. 7 Example of two type of visual output of the geographic dashboard of local assets. Scientific visualization of hydrogeologic conditions and basins (left) of cultural and architectural heritage (right) within the boundaries of the 18 municipalities engaged (*Source* own)

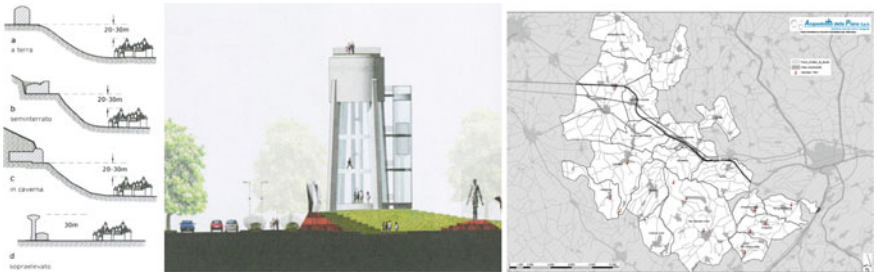

Fig. 8 Different configuration of piezometric tanks (left), draft design of one water tower (center), map of the tower's network (right) (*Source* P3ST plan)

on the opportunities to exploit the valued chains. However some other variables influencing circularity should be counting more as the impact of CE toward the global limits and the lasting of a CE process (degradation and limits of materials). Before the value chains, other factors can be related in order to envision different potentials of CE practices, to understand direct or indirect impacts and to select the proper leading stakeholders. None has been officially charged to overlook and regulate this processes and the way to involve policy-makers, the private sector or civil society (citizen/consumers) require a proper design thinking approach and open innovative solutions.

In this article, CE strategies were mainly divided between two big branches: one working with energy efficiency and another one with waste material flows. Two research studies applied this twofold objectives by first listening to wide communities and small groups of public authorities. Some suggestions of circular practices were envisioned with the help of a co-design process (one still ongoing). The output goes from policy frameworks to informative platforms that aims to enable people to participate or lead the transitions and to support the implementation of the circular practices.

In this sense, local communities/authorities and producers become active parts to co-create the circular ideas, for promoting collaborative economy and for making people, products and materials interact within the territories and build new ecosystem.

References

Andersen, M. S. (2007). An introductory note on the environmental economics of the circular economy. *Sustain Science, 2*, 133–140.

Boulding, K. (1966). *The economy of the coming spaceship earth.* In H. Daly, W. H. Freeman (Eds.), *Economics, ecology, ethics: Essay towards a steady state economy.* San Francisco.

CIRAIG (International Reference Centre for the Life Cycle of Products, Processes and Services). (2015). *Circular economy: A critical literature review of concepts.* Canada: Polytechnique Montréal.

COM (European Commission). (2015). *Closing the loop—An EU action plan for the circular economy*. Communication.
COM (European Commission). (2014). *Towards a circular economy: A zero waste programme for Europe* Communication. Brussels.
Daly, H. E. (1977). *The steady-state economy. The sustainable society: Implications for limited growth* (pp. 107–114). Praeger, New York and London.
Ellen MacArthur Foundation. (2015). *Growth within: A circular economy vision for a competitive Europe.*
European Parliamentary Research Service. (2017). *Towards a circular economy—Waste management in the EU. STUDY EPRS Scientific Foresight Unit (STOA).*
Georgescu-Roegen, N. (1971). *The entropy low and the economic process.* Harward University Press.
Korhonena, J., Honkasalob, A., & Seppäläc, J. (2017). Circular economy: The concept and its limitations. *Ecological Economics*, *143*, 37–46
Pearce, D. W., & Turner, R. K. (1989). *Economics of natural resources and the environment.* London: Hemel Hempstead, Harvester Wheatsheaf.
Petit, A., & Leipold, B. S. (2018). Circular economy in cities: Reviewing how environmental research aligns with local practices. *Journal of Cleaner Production, 195*, 1270–1281. Elsevier.
Roccasalva, G. & Corsico, F. (2012). The relevance of engaging the future in planning practices. In The Future of Cities and Regions, *Springer Geography*, https://doi.org/10.1007/978-94-007-2518-8_2.

Giuseppe Roccasalva Arch. Ph.D., Senior Research Fellow, Polytechnic of Turin, Turin, Italy. His research interests include sustainable design-led strategies, multi criteria environmental assessment, design decision support system, circular economy.