Springer Proceedings in Complexity

Anna Visvizi
Orlando Troisi
Kawther Saeedi *Editors*

Research and Innovation Forum 2021

Managing Continuity, Innovation, and Change in the Post-Covid World: Technology, Politics and Society

Springer

Springer Proceedings in Complexity

Springer Proceedings in Complexity publishes proceedings from scholarly meetings on all topics relating to the interdisciplinary studies of complex systems science. Springer welcomes book ideas from authors. The series is indexed in Scopus.

Proposals must include the following:

- name, place and date of the scientific meeting
- a link to the committees (local organization, international advisors etc.)
- scientific description of the meeting
- list of invited/plenary speakers
- an estimate of the planned proceedings book parameters (number of pages/articles, requested number of bulk copies, submission deadline)

Submit your proposals to: Hisako.Niko@springer.com

More information about this series at http://www.springer.com/series/11637

Anna Visvizi · Orlando Troisi ·
Kawther Saeedi
Editors

Research and Innovation Forum 2021

Managing Continuity, Innovation, and Change in the Post-Covid World: Technology, Politics and Society

Springer

Editors
Anna Visvizi
SGH Warsaw School of Economics
Warsaw, Poland

Orlando Troisi
University of Salerno
Fisciano, Italy

Kawther Saeedi
King Abdulaziz University
Jeddah, Saudi Arabia

ISSN 2213-8684 ISSN 2213-8692 (electronic)
Springer Proceedings in Complexity
ISBN 978-3-030-84310-6 ISBN 978-3-030-84311-3 (eBook)
https://doi.org/10.1007/978-3-030-84311-3

© The Editor(s) (if applicable) and The Author(s), under exclusive license
to Springer Nature Switzerland AG 2021
This work is subject to copyright. All rights are solely and exclusively licensed by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.
The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.
The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

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

Preface

Research and Innovation Forum 2021: Managing Continuity, Innovation, and Change in the Post-Covid World: Technology, Politics, and Society

The **Research and Innovation Forum** (Rii Forum) is an annual conference that brings together researchers, academics, and practitioners in conceptually sound inter- and multi-disciplinary, empirically driven debate on key issues influencing the dynamics of social interaction today. Technology, innovation, and education define the rationale behind the Rii Forum and are at the heart of all discussions held during the conference. The COVID-19 pandemic and its social, political, and economic implications had confirmed that a more thorough debate on these issues and topics was needed. For this reason, the Rii Forum 2021 was devoted to the broadly defined question of the short- and long-term impact of the pandemic on our societies. Indeed, the Rii Forum 2021 served as a virtual arena for debate on how sophisticated information and communication technology (ICT), including artificial intelligence (AI), blockchain, big data, cloud and edge computing, 5G, Internet of Things (IoT), and social networking, could help stakeholders to manage continuity, innovation, and change in the post-Covid world.

As an inter- and multi-disciplinary conference that offers a broad view on the issues and topics related to advances in ICT, the Rii Forum 2021 sought to encourage insights from a range of research domains and academic disciplines. For this reason, the conceptual foundations of the Rii Forum 2021 were drawn from social sciences, management science, computer science, as well as education science and humanities.

Rii Forum 2021 was organized under conditions of immense uncertainty driven by the ever-changing dynamics of the COVID-19 pandemic and its implications. Indeed, COVID-19 has redefined not only the way business is conducted, but also how culture is "delivered" to entire societies. The pandemic and the quarantine that the majority of our societies were subjected to altered several social interactions, in many ways fostering a new quality of human–computer interactions. For these reasons, the Rii Forum 2021 aimed at stimulating a discussion on the multiple

facets the pandemic's impact on technology, the society, the business sector, and the art of management as well as on political systems, including democracy.

In the original open call for panels and papers, the following topics and issues were highlighted as of particular interest of the steering and the program committees: the establishment and consolidation of alliances among diverse stakeholders; the use of data and data-driven strategies to inform policy-making at local, regional, national, and global levels; COVID-19 driven new divisions between the Global North and Global South; social implications of the COVID-19 pandemic: migration, exclusion, and poverty; a weakening of democracy, transparency, and civic and human rights; the management of pandemics and their implications through the use of AI, and its value in health care, education, smart cities, economics, and foreign policy. A closer insight into the actual application of technology was also encouraged. The topics of particular interest included: blockchain and its application to the post-Covid world; social networking sites and digital space vs politics, economics, and business; information management in times of uncertainty; COVID-19 and the international economy in the AI-era: crisis, rupture, and new opportunities. In response to the initial call for panel and paper proposals, the following panels were proposed and successfully executed.

- Panel 1: Technology, education and online learning in times of the pandemic
- Panel 2: Immersive technologies as a tool for coping with COVID-19 in higher education
- Panel 3: Health and well-being in smart cities: urban design and urban planning in the COVID-19 era
- Panel 4: Smart Cities in the COVID-19 era: SDGs and resilience
- Panel 5: Smart cities, public health and infectious diseases
- Panel 6: Cultural heritage and ICT
- Panel 7: Depopulation, the global competition for talent, and the digital diaspora
- Panel 8: Democracy in the post-Covid world
- Panel 9: AI in the international and global perspective
- Panel 10: Data-driven decision making and strategy in business
- Panel 11: Human–human and human–machine interaction amid the COVID-19 pandemic

Considering that the COVID-19 pandemic persisted throughout 2020, and in early Spring 2021 only few travel restrictions were lifted, the **Rii Forum 2021** was held online, i.e., via a specialized online communication platform. Once again, the Rii Forum 2021 conference attracted delegates from nearly all continents, including North and South America, Asia, the Arab Peninsula, Europe and Sub-Saharan Africa. The conference was held on April 7–9, 2021, and consisted of sixteen panel sessions. In addition, two keynote speeches were delivered, and a roundtable discussion was held. With regard to the keynote speeches. On April 7, 2021, the Rii Forum 2021 delegates had the opportunity to listed to Professor Erkki Ormala, Senior Fellow, Innovation Management, School of Business, Aalto University. The title of his speech was "Successful innovations drive economic growth". On April

8, 2021, the Rii Forum 2021 delegates were invited to join the keynote speech, titled "Bottom-Up Culture Creates Born Global Success Stories: The Case of Helsinki Uusimaa Region", by Mr. Ari Huczkowski, the CEO of LUMINTEL. The roundtable debate held on Friday, April 9, 2021, was organized jointly by Rii Forum and the Institute for Democracy and Electoral Assistance (IDEA). The topic of the roundtable discussion was "Global democratic trends before and during the COVID-19 pandemic" [1]. The speakers, and corresponding titles of the opening presentations, included:

- Alberto Fernandez, IDEA, "Taking stock of global democratic trends before and during the COVID-19 pandemic,"
- Lucy J. Parry, Ph.D., Centre for Deliberative Democracy and Global Governance, University of Canberra, Canberra, Australia & Webster Vienna Private University, Wien, Austria, "Democracy in flux: a systemic view on the impact of COVID-19" [2], and
- Miguel Angel Lara Otaola, Ph.D., IDEA, "Elections and COVID-19: Safeguarding health, integrity and trust."
- The discussion was moderated by Professor Anna Visvizi.

Nearly 100 extended paper proposals were submitted in response to the initial call for papers. Off these proposals, as a result of the stringent review process, only 58 papers are included in the proceedings. This suggests that the acceptance–rejection ratio stands at 60:40. All papers were subjected to several rounds of a double-blind peer review process (at least two reviews in each round of the review process). Reflecting the inter- and multi-disciplinary focus and scope of the Rii Forum 2021, the papers included in this volume are grouped into four broad thematic sections. These include:

- Technology-enhanced teaching and learning in times of COVID-19
- Smart cities in times of COVID-19
- COVID-19 and the business sector
- COVID-19, the political system, migration, well-being

The papers included in these **Rii Forum 2021 proceedings** serve as evidence that in times of uncertainty more inter- and multi-disciplinary research is needed to inform the decision- and the policy-making process. This volume offers a unique view not only of the impact of COVID-19 on our societies but also of ways of navigating the challenges that emerged.

We are indebted to the keynote speakers, Professor Erkki Ormala and Mr Ari Huczkowski for sharing their precious time and unique expertise with the **Rii Forum 2021** delegates. We remain grateful to the **Rii Forum Steering Committee** and the **Rii Forum Program Committee** for their commitment, sound judgment, and hard work in the process of organizing the **Rii Forum 2021** and then successfully moving the conference to the virtual space. We would like to say "thank you" to all contributing authors for their hard work and their patience in subsequent rounds of the "revise and resubmit" process. It would not be possible without the

reviewers who devoted countless hours to evaluate papers submitted to this volume. Finally, we would like to express our gratitude to the entire Springer team and the Editors of Complexity for their continued support and guidance.

We remain hopeful that the forthcoming Rii Forum 2022 will be held onsite and that the online mode of the conference delivery will be just an option. Please check the **Rii Forum** web site (https://rii-forum.org) for updates.

Sincerely,

Anna Visvizi
Orlando Troisi
Rii Forum 2021 Chairs

References

1. IDEA (2020) Taking Stock of Global Democratic Trends Before and During the COVID-19 Pandemic, The Global State of Democracy in Focus, Special Brief, December 2020, https://www.idea.int/sites/default/files/publications/global-democratic-trends-before-and-during-Covid-19-pandemic.pdf
2 Parry, L.J., Asenbaum, H. and Ercan, S.A. (2021), "Democracy in flux: a systemic view on the impact of COVID-19", Transforming Government: People, Process and Policy, Vol. 15 No. 2, pp. 197-205. https://doi.org/10.1108/TG-09-2020-0269

Acknowledgments

The Rii Forum 2021 Chairs would like to extend their heartfelt “thank you” to the Rii Forum 2021 keynote speakers, i.e., Professor Erkki Ormala, Senior Fellow, Innovation Management, School of Business, Aalto University, and Mr Ari Huczkowski, the CEO of LUMINTEL. Insiders understand very well how a poignant distinction it is to be able to host both speakers. We are grateful for that.

We would also like to thank our dear colleagues and friends, who responded to the initial call for panels and papers, thus making the Rii Forum 2021 a truly inter- and multi-disciplinary conference. Even more so, we would like to thank all Rii Forum 2021 delegates for creating a friendly and welcoming atmosphere at the conference; an atmosphere filled with respect, self-discipline (think of the presentation time!), as well as rich in critical and constructive feedback. We cannot thank you enough.

We would also like to extend our gratitude to the Rii Forum 2021 reviewers. You did an amazing work. Thank you!

Finally, we would like to thank the Publisher, Springer Nature, and its entire team for granting us the opportunity to collaborate on this volume. We appreciate it.

Very kind regards,

Anna Visvizi
Orlando Troisi
Rii Forum 2021 Chairs

Organization

Rii Forum 2021 Chairs

Anna Visvizi	SGH Warsaw School of Economics, Warsaw, Poland
Orlando Troisi	University of Salerno, Fisciano, Italy

Rii Forum 2021 Steering Committee Members

Higinio Mora	Computer Technology Dpt., University of Alicante, Spain
Miguel Jesús Torres-Ruiz	Instituto Politécnico Nacional, Mexico
Kawther Saeedi	King Abdulaziz University, Jeddah, Saudi Arabia
Orlando Troisi	University of Salerno, Fisciano, Italy
Anna Visvizi	SGH Warsaw School of Economics, Warsaw, Poland
Yenchun Jim Wu	Graduate Institute of Global Business and Strategy, National Taiwan Normal University, Taiwan

Program Committee (in alphabetical order)

Marie-Hélène Abel	Sorbonne universités, Université de technologie de Compiègne, UTC, Compiegne, France
Antonella Carbonaro	Department of Computer Science and Engineering University of Bologna, Italy
Jari Jussila	HAMK Smart Research Unit, Häme University of Applied Sciences, Finland

Mu-Yen Chen	Department of Engineering Science, National Cheng Kung University, Tainan, 701, Taiwan
Wim Naudé	RWTH Aachen University, Aachen, Germany
Raquel Perez-del-Hoyo	Building Sciences and Urbanism Department, Urban Design and Regional Planning Unit, University of Alicante, Spain
Placido Pinheiro	Graduate Program in Applied Informatics, University of Fortaleza, Brazil
Shahira Assem Abdel Razek	Architecture, Delta University for Science and Technology, Egypt
Lucie Rohlíková	University of Western Bohemia, The Czech Republic
Cláudia Toriz Ramos	Universidade Fernando Pessoa & Researcher CEPESE, Universidade do Porto, Portugal
Kawther Saeedi	Information Systems, Faculty of Computing and Information Technology, King Abdulaziz University, Saudi Arabia
Enric Serradell-Lopez	Business Administration and Management Department of the Open University of Catalonia, Spain
Chien-Wen Chen	Department of Business Administration National Central University, Taiwan
Marco Spruit	Applied Data Science, Utrecht University, Department of Information and Computing Sciences, Utrecht, The Netherlands
Aleksander Surdej	Cracow University of Economics, Cracow, Poland
Yves Wautelet	Research Centre for Information Systems Engineering (LIRIS), Brussels Campus, KU Leuven, Belgium

Contents

Covid-19, Advances in ICT and the Society

ICT and Social Value Co-Creation During the Covid-19 Emergency: The Case of MascherinAmica 3
Ciro Clemente De Falco and Emilia Romeo

Application of Machine Learning to Infer Symptoms and Risk Factors of Covid-19 13
Evandro Carvalho de Andrade, Placido R. Pinheiro, Raimir Holanda Filho, Luciano C. Nunes, Mirian C. D. Pinheiro, Wilson Correia de Abreu, Marum Simão Filho, Luana I. C. C. Pinheiro, Maria L. D. Pereira, Pedro G. C. D. Pinheiro, and Rafael Comin-Nunes

How Does the Citizens' Behavioral Intention to Use Digital Technology in Smart Cities Affect Their Mental Health During the Covid-19 Pandemic? 25
Hongxin Wang, Wenqing Wu, and Yenchun Jim Wu

The Role of Blockchain Technology During Covid-19 in the Healthcare Sector 35
Vilma Çekani

Technology Impacts on Employee Engagement During Covid-19 45
Matthew Woods

An Ethereum-Based Chain for Diagnosis and Control of Covid-19 59
Carlo Alessandro Sirianni, Parisa Sabbagh, and Francesco Marra

Data-Driven Decisions for a Smarter and Resilient Healthcare Service Ecosystem 69
Luca Carrubbo, Antonietta Megaro, and Francesco Notari

A Mobile Application with Geolocation and Virtual Rewards for Promoting Social Skills in People with Social Disorders 79
Aurora Polo-Rodriguez, Javier Medina-Quero, Magnus Johnsson, David Gil, and Ignasi Navarro

Recognition of Hygiene Activities by Means of Multimodal Sensors . . . 89
Aurora Polo-Rodriguez, Federico Cruciani, Chris Nugent, and Javier Medina-Quero

Improvement of a Sign Language Learning Reinforcement Tool Through Phonological Proximity 99
Luis Naranjo-Zeledón, Mario Chacón-Rivas, Jesús Peral, Antonio Ferrández, and David Gil

Determining the Benefits and Drawbacks of Agile (Scrum) and DevOps in Addressing the Development Challenges of Cloud Applications 109
Konstantinos Tsilionis, Sarah Sassenus, and Yves Wautelet

A Double Blockchain-Based Consumption Model Using a Gamification Social Environment 125
Ciro D'Apice, Claudia Pipino, Carmine De Nicola, and Chiara Marciano

Architecture Based on Machine Learning Techniques and Data Mining for Prediction of Indicators in the Diagnosis and Intervention of Autistic Spectrum Disorder 133
David Gil, Magnus Johnsson, Julian Szymanski, Jesús Peral, and Mohan Tanniru

Technology-Enhanced Teaching and Learning in Times of Covid-19

Monitoring Massive Open Online Courses (MOOC) During the Covid-19 Pandemic 143
Filippo Sciarrone and Marco Temperini

Intelligent Information and Communication Technology Innovation Management in Higher Education 155
Rustom Mamlook, Taysir Garadah, Salman Riaz, Abdul-Aziz Mohamed Jouda Salama, Taysir Mohammad Nahar Alkhazali, Alajab Mohammed Alajab Ismail, and Misbah Tabassum

How to Cultivate Personal Learning and Professional Growth in Times of Disruption, Resistance and Collective Transformation? 165
Alessandra Romano

Impact of the Covid-19 Pandemic on Education: A Case from a Military Academy 179
Piotr Szczepański and Małgorzata Pacer

ICT Extra-curricular Activities: The "Digital Girls" Case Study for the Development of Human Capital 193
Francesco Faenza, Claudia Canali, and Antonella Carbonaro

Digitization of Material Culture Resources and Its Impact on Poles' Participation in "Cyberculture" During the Covid-19 Pandemic 207
Marek Bodziany and Justyna Matkowska

The Challenges Educators Face in Virtually Creating High Quality LMX with Students and Colleagues 219
Kelli D. Kidwell

On Techniques to Detect Concept Maps Pedagogical Similarity 231
Carla Limongelli, Filippo Sciarrone, and Marco Temperini

Smart Cities in Times of Covid-19

New Shades on the Smart City Paradigm During Covid-19: A Multiple Case Study Analysis of Italian Local Governments 245
Gennaro Maione and Francesca Loia

Resilient Urban Open Public Spaces in During the Covid-19 Pandemic 253
Shahira Assem Abdel-Razek and Yasmin Moanis

Minimum Areas of Confinement: Towards a Post-Covid-19 Urbanism 269
Raquel Pérez-delHoyo, Higinio Mora, and Laura Ferrando-Martínez

Containing the Spread of Covid-19 Through Spatial Planning: The Case of Warsaw 279
Radosław Malik and Anna Zdyb

The Implementation and Use of Technologies and Big Data by Local Authorities During the Covid-19 Pandemic 295
Vincenzo Marrazzo

Artificial Intelligence and Fuzzy Cognitive Map for Supporting Urban Decision-Making During the Covid-19 Pandemic 305
Francesca Loia and Roberto Vona

Exploring the Differentiating Characteristics Between the Smart City and the Smart Society Models 313
Erick Varela-Guzmán, Higinio Mora, and Anna Visvizi

Smart Cities from Slow Philosophy 321
Pablo de-Gracia-Soriano and Diana Jareño-Ruiz

Covid-19 and the Business Sector

Managing Global Epidemic Through Resilience: A Prism for Resilient Smart Cities 333
Orlando Troisi and Mara Grimaldi

Business Governance in Emergent Contexts: Firms and Artificial Intelligence During the Covid-19 Pandemic. A Systematic Literature Review 343
Francesco Polese and Gianluca Maria Guazzo

Business Dynamics in Times of Covid-19: The Link Between Organizations' Performance and Uncertainty of Corporate Information 353
Carlo Torre and Francesco Marra

Business Simulations in Times of the Covid-19: Their Effectiveness Through Online and Face-to-Face Instruction 361
Ana Beatriz Hernández-Lara and Daniele Gualdi

Data-Driven Decision-Making in Circular Economy SMEs in Finland . . 371
Anne-Mari Järvenpää, Iivari Kunttu, Jari Jussila, and Mikko Mäntyneva

Let Thy Food Be Thy Medicine: Exploring the Impact of Covid-19 Pandemic on the Online Food Delivery Industry 383
Francesco Smaldone, Mario D'Arco, Vittoria Marino, and Marco Pellicano

ICT Platforms and the Restaurant Business in Times of Covid-19: The Case of Italy 393
Antonio Botti and Antonella Monda

Exploring the Link Between Customers' Safety Perception and the Use of Information Technology in the Restaurant Sector During the Covid-19 403
Benedetta Esposito, Maria Rosaria Sessa, Daniela Sica, and Ornella Malandrino

Online DMO (Destination Marketing Organization) for Meeting Industry 417
Gianluca Mansi

Brave Consumers for a New Digital World: Exploring Online Shopping Motives During Covid-19 425
Francesco Smaldone, Mario D'Arco, Vittoria Marino, and Marco Pellicano

Towards Smart Data Management of Scientific Literature: Addressing Polysemy and Aberrant Decoding in Author Names 435
Sidra Khalid, Saeed-Ul Hassan, and Asamaporn Sitthi

Enhancing Innovativeness of China's Economy Through Attracting Global Talent 447
Małgorzata Dziembała

Future China: AI Leader in 2030? 455
Marina S. Reshetnikova

Covid-19: the Political System, Migration, and Well-Being

Threats to Democracy During the Covid-19 Pandemic: The Case of Poland 467
Wojciech Horyń

The Polish Covid-19 Legislation. Strategy of the Populist Government During the Pandemic Crisis 481
Jarosław Suchoples

The Spanish Political Debate During the Covid-19 Pandemic: The Case of the Twitter Debate 495
Carles Vañó-Agulló, Pablo de-Gracia-Soriano, and Diana Jareño-Ruiz

Virulence of Two Infectious Diseases: Inequality and Covid-19 503
Francesco Smaldone, Mario D'Arco, Vittoria Marino, and Marco Pellicano

Because of Snowden? The Three Leakers and Privacy Issues in the Cyber Matrix 513
Emanuel Boussios

Quarantining in Croatia: Has the Covid-19 Pandemic Spurred Homeland Return? 529
Caroline Hornstein Tomić, Dora Bagić, and Maja Kurilić

"Working from Home": Government Initiatives to Promote Returning to Latvia Amidst the Covid-19 Pandemic 541
Agnese Lāce

Brain Circulation and Return Migration in Slovenia Before and During the Covid-19 Pandemic 549
Dejan Valentinčič

Has Covid-19 Put a Halt to Youth Migration? Preliminary Evidence from Poland 567
Piotr Maleszyk

What a Manager Wants? How Return Migrants' Experiences are Valued by Managers in the Baltics 577
Kata Fredheim and Zane Varpina

Global Impacts of ICT-Qualified Worker Shortage: Exploring the Need for Educational, Firm-Based, and Societal Investments in ICT Human Capital 589
Jennifer Moss Breen and Antonella Carbonaro

Grief, Growth, and Silver Linings: Humanistic Leadership During the Covid-19 Pandemic 599
Angela Lehr and Susie Vaughan

Author Index 611

New Shades on the Smart City Paradigm During Covid-19: A Multiple Case Study Analysis of Italian Local Governments

Gennaro Maione and Francesca Loia

Abstract Due to the chaotic circumstances related to the pandemic, new challenges and opportunities are emerging in several sectors, including the urban context. From the point of view of local governments, there could be repercussions in terms of digital growth and increased effort in the creation of smart, sustainable, accountable, and interconnected cities. The main purpose of this paper is to contribute to the debate on the new connotations of the smart city paradigm due to the spread of Covid-19, in particular in identifying new key elements of the smart cities initiatives emerged by the current scenario, in addition to those identified by the consolidated literature. To meet this knowledge requirement, this study in based on a qualitative investigation approach that follows the multiple case study model. Interviews with directors, managers, and technicians of local governments shed light on new categories connected to the smart city paradigm due to the pandemic situation which, combined together, allow "transforming" the acronym of S.M.A.R.T. into a new one here proposed: Safety; Mitigation; Accountability; Resilience; Traceability. In this sense, the study offers several insights, potentially capable of generating useful implications for both researchers and professionals in the public sector.

Keywords Smart city · Local governments · Digital technologies · Covid-19 · Resilience · Multiple case study

G. Maione
Department of Business Science - Management and Innovation Systems, University of Salerno, Fisciano, Italy

F. Loia (✉)
Department of Economics, Management and Institutions, University of Naples 'Federico II', Naples, Italy
e-mail: francesca.loia@unina.it

© The Author(s), under exclusive license to Springer Nature Switzerland AG 2021

A. Visvizi et al. (eds.), *Research and Innovation Forum 2021*,
Springer Proceedings in Complexity, https://doi.org/10.1007/978-3-030-84311-3_22

1 Introduction

Covid-19 is definitely changing the way we live on the planet but at the same time it is also shedding new light on the benefits that digital revolution can bring to our society [10, 28]. Especially from the point of view of local governments, there could be repercussions in terms of digital growth and increased effort in the creation of smart, sustainable, accountable, and interconnected cities [14–16].

The purpose of this paper is to contribute to the debate on the new connotations of the smart city paradigm due to the spread of Covid-19, in particular in identifying new key elements and common areas of application of the smart cities initiatives emerged by the current scenario, in addition to those identified by the consolidated literature [1]. This study in based on a qualitative investigation approach that follows the multiple case study model [20]. The local governments of four Italian cities considered to be leaders in the field of smart city development are analyzed. Interviews with directors, managers, and technicians shed light on new categories connected to the smart city paradigm due to the pandemic situation which, combined together, allow "transforming" the acronym of S.M.A.R.T. into a new one here proposed: Safety; Mitigation; Accountability; Resilience; Traceability.

The paper is structured as follows: Sect. 2 offers a detailed overview about the paradigm of smart city; Sect. 3 introduces the methodology adopted based on a qualitative analysis; Sect. 4 discusses the results obtained; Sect. 5 lists main theoretical and practical implications and it also draws main conclusions.

2 The Smart City Paradigm Before Covid-19

In the last twenty years, the concept of "smart city" has been being the subject of significant attention in the field of governance, urban planning, managerial studies, and information technology [12, 21, 29]. This concept is rooted from the need to respond to current urban and social challenges, such as hasty population growth, increasing global consumption of energy and greenhouse gas emissions and so on. Smart city, in general, refers to a comprehensive view of the urban context which is able to merge information, sustainable development and digital platforms in only one framework [6, 23]. Smart city follows the revolution of the development and diffusion of Information and Communication Technologies (ICTs), being able to be defined as the result deriving from the combination of key factors such as technology (hardware and software infrastructures), people (inspiration, diversity and formation) and institutions (governance and politics) [21] (Bartels et al. [5]). Accordingly, the merging of computing, Internet technology and telecommunications has supported the development of sensory devices that work together across larger infrastructures, focusing on data processing, exchange, storage and security [17]. ICTs infrastructure is related to numerous emerging and optimized technologies which act as enablers of advanced smart city services [15, 30, 31].

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) [4]. Also, the ICT-based platforms offer a wide range of information and data on the city in relation to different areas and citizens can participate directly in the development and co-production of high value-added services [24, 31]. 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 stakeholders [19, 29]. 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 [18].

However, the use of ICTs in an urban context is not sufficient to qualify a city as smart, given that in addition to the potential offered by the technological revolution, additional factors must be involved [9, 25], bringing together in an wide-ranging view the economic, social, governmental and environmental dimensions [1, 22, 27], with the aim of proposing a coherent program of urban improvement and services (see Fig. 1).

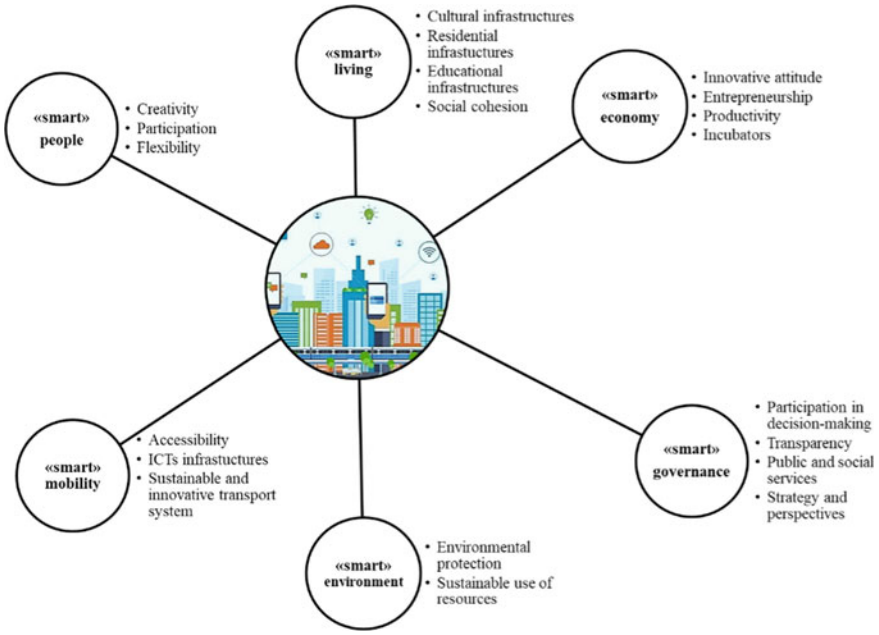

Fig. 1 Smart City's key dimensions from Stratigea [27] and Albino et al. [1]

3 Methods and Data

This paper follows a qualitative approach by means of the collection, analysis, and interpretation of unstructured and non-numerical data [8]. This approach offers several advantages such as the depth of analysis, high conceptual validity, understanding of context and process, and finally the possibility of promoting new hypotheses and new research questions [33]. The basic scheme of the interviews administered has been defined by enucleating and adapting the key concepts related to the expression "Smart city" from the Public Management literature by means of five open-ended questions: 1) "How do you define a smart city?"; 2) "What are the typical characteristics of each smart city?"; 3) "What are the limits of the current concept of smart city?"; 4) "How have smart cities reacted to the Covid-19 pandemic?"; 5) "Which direction should smart cities point in the near future?". After, an email presenting the research project and a request for membership were sent to practitioners involved within an Italian smart city projects, such as directors, managers, and technicians. A total of 234 emails were sent but only 119 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 57 practitioners agreed to take part in the project by responding to the interview. However, only 41 of them returned the updated file with their responses. Overall, the data collection phase lasted about five months, from September 2020 to January 2021. The collected data were analyzed separately by the two authors. Subsequently, the comparison between the authors became necessary to better target the connotations of the smart city paradigm due to the spread of Covid-19.

4 Results and Discussion

Interviews with directors, managers, and technicians belonging to local governments have led to the detection of new categories connected to the smart city paradigm due to the pandemic situation which, combined together, allow "transforming" the acronym of S.M.A.R.T. into a new one: Safety; Mitigation; Accountability; Resilience; Traceability).

S – Safety

One of the main focus emerged by the analysis of the interviews is the issue about the safety and security in cities of the future. In the context of smart city, safety can include several important features such as healthcare, smart traffic systems, smart safety systems for surveillance, smart systems of crisis management to support decision making and so on [13]. However, safety issues have become particularly central during the spread of Covid-19. In fact, the virus outbreak from

an urban standpoint should push towards a standardization protocols for increased data sharing in the event of outbreaks or disasters, leading to better global understanding and management of the same (Allam and Jones [2]).

M – Mitigation

In the smart city model, mitigation strategies suggest a wider set of systemic interventions including security-by-design, remedial security patching and replacement, formation of core security and computer emergency response teams, a change in procurement procedures, and continuing professional development [11]. Especially during the Covid-19 emergency, mitigation approaches should be encouraged and complemented by market-based and governance-based incentives and regulation in order to develop a radical preventative strategy.

A – Accountability

Accountability in the smart city model has always gained attention. A good governance in smart cities aims to promote the shared interests of the city while creating accountability and trust by improving the transparency in data flow and decision-making, while ensuring that no social gaps occur in the access to shared data [3]. Especially, the current Covid-19 pandemic has had unprecedented impacts on the importance of accountability.

R – Resilience

The concept of resilience connected to urban context has been broadly discussed by the literature [26]: resilient city is able to tolerate disruptions before reorganising around new set of structures and is able to anticipate, prepare for, respond to and recover from a disturbance. The case of the Covid-19 virus has particularly emphasised the role of urban resilience which can be achieved thanks to achievement of standardized communication across and between smart cities (Allam and Jones [2]).

T – Traceability

In the smart city context, traceability covered an important role. In fact, thanks to emerging technologies it is possible to track and trace information in order to ensure the maximum circularity, speed, precision, and efficiency in the governance processes. This approach can be considered particularly crucial in Covid-19 context characterized by high complexity and variety. In fact, in this context several systems have been developed able to collect data and also ensure user privacy by including a decentralized traceability subsystem based on blockchain [7].

5 Final Remarks and Conclusions

This work has responded to several calls from the smart city literature to study how is changing smart city paradigm in the light of spread of COVID-19. From the qualitative analysis carried out emerges that pandemic crisis has given new evidence to the importance of digital infrastructure. Local governments can benefit from these findings for revaluating the governance approach and programs in the light of innovative mechanism and technologies.

From a managerial point of view, the results of the analysis suggest that it is necessary to invest in the accountability of local governments initiatives in order to strengthen the trust of citizens by ensuring the transparency in data flow and decision-making initiatives [32]. Especially in light of Covid-19 pandemic, a coordinated response across different sectors based on cooperation mind-set, digital platforms, and service providers can definitely improve the global response to the crisis.

On the other hand, from a theoretical point of view, appears evident that the Covid-19 crisis has pushed the smart cities on to include resilience thinking into their recovery strategies. As a result, municipalities and the public health system should implement disruptive technologies along with a resilient thinking, with the aim to adopt digital approaches as well as to strengthen communities against future shocks and stresses—whether economic, social or environmental.

References

1. Albino, V., Berardi, U., Dangelico, R.M.: Smart cities: definitions, dimensions, performance, and initiatives. J. Urban Technol. **22**(1), 3–21 (2015)
2. Allam, Z., Jones, D.S.: On the coronavirus (COVID-19) outbreak and the smart city network: universal data sharing standards coupled with artificial intelligence (AI) to benefit urban health monitoring and management. In: Healthcare, vol. 8, no. 1, p. 46. Multidisciplinary Digital Publishing Institute, March 2020
3. Allam, Z., Newman, P.: Redefining the smart city: culture, metabolism and governance. Smart Cities **1**(1), 4–25 (2018)
4. Anthopoulos, L.G., Vakali, A.: Urban planning and smart cities: interrelations and reciprocities. In: The Future Internet Assembly, pp. 178–189. Springer, Heidelberg (2012)
5. Bartels, A.H., Daley, E., Parker, A., Evelson, B., Muteba, C.: Smart Computing Drives the New Era of IT Growth. Forrester Inc. (2009)
6. De Jong, M., Joss, S., Schraven, D., Zhan, C., Weijnen, M.: Sustainable–smart–resilient–low carbon–eco–knowledge cities; making sense of a multitude of concepts promoting sustainable urbanization. J. Clean. Prod. **109**, 25–38 (2015)
7. Fernández-Caramés, T.M., Froiz-Míguez, I., Fraga-Lamas, P.: An IoT and blockchain based system for monitoring and tracking real-time occupancy for COVID-19 public safety. In: Engineering Proceedings. MDPI, Switzerland (2020)
8. Hennink, M., Hutter, I., Bailey, A.: Qualitative Research Methods. SAGE Publications Limited, California (2020)
9. Hollands, R.G.: Will the real smart city please stand up? Intelligent, progressive or entrepreneurial? City **12**(3), 303–320 (2008)

10. Jaiswal, R., Agarwal, A., Negi, R.: Smart solution for reducing the COVID-19 risk using smart city technology. IET Smart Cities **2**(2), 82–88 (2020)
11. Kitchin, R., Dodge, M.: The (in) security of smart cities: vulnerabilities, risks, mitigation, and prevention. J. Urban Technol. **26**(2), 47–65 (2019)
12. Komninos, N., Schaffers, H., Pallot, M.: Developing a policy roadmap for smart cities and the future internet. In: eChallenges e-2011 Conference Proceedings, IIMC International Information Management Corporation. IMC International Information Management Corporation, Dublin (2011)
13. Lacinák, M., Ristvej, J.: Smart city, safety and security. Procedia Eng. **192**, 522–527 (2017)
14. Loia, V., Maione, G., Tommasetti, A., Torre, C., Troisi, O., Botti, A.: Toward smart value co-education. In: Smart Education and e-Learning 2016, pp. 61–71. Springer, Cham (2016)
15. Lytras, M.D., Visvizi, A.: Who uses smart city services and what to make of it: toward interdisciplinary smart cities research. Sustainability **10**(6), 1998 (2018)
16. Lytras, M.D., Visvizi, A., Sarirete, A.: Clustering smart city services: perceptions, expectations, responses. Sustainability **11**(6), 1669 (2019)
17. Lytras, M.D., Visvizi, A., Chopdar, P.K., Sarirete, A., Alhalabi, W.: Information management in smart cities: turning end users' views into multi-item scale development, validation, and policy-making recommendations. Int. J. Inf. Manage., 102146 (2020)
18. Lytras, M., Visvizi, A., Zhang, X., Aljohani, N.R.: Cognitive computing, Big Data Analytics and data driven industrial marketing **90**(1), 636–666 (2020)
19. Lytras, M.D., Visvizi, A.: Information Management As a Dual-Purpose Process in the Smart City: Collecting, Managing and Utilizing Information. Elsevier, Netherland (2020)
20. Mora, L., Deakin, M., Reid, A.: Strategic principles for smart city development: a multiple case study analysis of European best practices. Technol. Forecast. Soc. Change **142**, 70–97 (2019)
21. Nam, T., Pardo, T.A.: 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 (2011)
22. Neirotti, P., De Marco, A., Cagliano, A.C., Mangano, G., Scorrano, F.: Current trends in smart city initiatives: some stylised facts. Cities **38**, 25–36 (2014)
23. Pellicano, M., Calabrese, M., Loia, F., Maione, G.: Value co-creation practices in smart city ecosystem. J. Serv. Sci. Manage. **12**(1), 34–57 (2018)
24. Polese, F., Troisi, O., Carrubbo, L., Grimaldi, M.: 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, Netherland (2018)
25. Shapiro, J.M.: Smart cities: quality of life, productivity, and the growth effects of human capital. Rev. Econ. Stat. **88**(2), 324–335 (2006)
26. Simone, C., Iandolo, F., Fulco, I., Loia, F.: Rome was not built in a day. Resilience and the eternal city: insights for urban management. Cities, 110 (2021)
27. Stratigea, A.: The concept of 'smart cities'. Towards community development? Netcom. Réseaux, communication et territoires **26**(3/4), 375–388 (2012)
28. Tommasetti, A., Mussari, R., Maione, G., Sorrentino, D.: Sustainability accounting and reporting in the public sector: towards public value co-creation? Sustainability **12**(5), 1909 (2020)
29. Visvizi, A., Lytras, M. (eds.) Smart Cities: Issues and Challenges: Mapping Political, Social and Economic Risks and Threats. Elsevier, Netherland (2019)
30. Visvizi, A., Lytras, M.D.: Rescaling and refocusing smart cities research: from mega cities to smart villages. J. Sci. Technol. Policy Manage. **9**(2), 134–145 (2018)
31. Visvizi, A., Lytras, M.D., Damiani, E., Mathkour, H.: Policy making for smart cities: innovation and social inclusive economic growth for sustainability. J. Sci. Technol. Policy Manage. **9**(2), 126–133 (2018)
32. Yeo, J., Lee, E.S.: Whole community co-production: a full picture behind the successful COVID-19 response in S. Korea. Transform. Gov. People Process Policy (2020)
33. Yin, R.K.: Validity and generalization in future case study evaluations. Evaluation **19**(3), 321–332 (2013)