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PREFACE

Smart cities and smart governance models for future cities

Current research and future directions

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The role of smart governance in smart cities

In the last two decades, the concept of smart cities has attracted significant research and policy attention. Despite its extensive discussion in literature, the term smart city is a fuzzy concept (Albino et al., 2015; Angelidou, 2014; Anthopoulos, 2015). It commonly refers to environments in which information and communication technologies (ICTs) are utilized to offer innovative services to citizens in order to enhance their well-being and to stimulate sustainable economic growth (Yigitcanlar et al., 2018). According to Giffinger et al. (2007), the key defining characteristics of smart cities include smart economy, smart people, smart governance, smart mobility, smart environment, and smart living, addressing key topics such as economic competitiveness, educational level of citizens, quality of social interactions, flexibility of labor market, governmental strategies, innovative transportation systems, sustainable resource management, or public safety. However, since the introduction of the term smart cities in the '90 s, numerous perspectives on smart cities have emerged (e.g., Chourabi et al., 2012; Dameri & Cocchia, 2013; Hosseini et al., 2018; Yigitcanlar et al., 2018).

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One predominant perspective relates to the role of smart ICTs to improve the quality of citizens' life (e.g., Bifulco et al., 2016; Dameri, 2017; Ferro et al., 2013; Gade, 2019; Van Dinh et al., 2020). Smart ICTs are wireless, embedded in objects, and record the environment using sensors (Yigitcanlar & Lee, 2014). They provide the critical infrastructure for more intelligent and interconnected solutions in areas such as healthcare, real estate, utilities, transportation, public safety, and administration (Washburn et al., 2009). In the energy grid domain, for example, smart ICTs help collect and share consumption data to optimize energy management (Farmanbar et al., 2019). In the transportation domain, smart ICTs enable safe, socially inclusive, and sustainable multi-modal transportation networks, which allow citizens to travel with ease (Herrenkind et al., 2019; Lembcke et al., 2021; Nastjuk et al., 2020; Nikitas et al., 2017; Rocha et al., 2020; Trang et al., 2015). In the building domain, smart ICTs can help to establish so-called "zero energy buildings" by significantly reducing the energy demand during the lifecycle of residential and commercial buildings (Kylili & Fokaides, 2015). In the healthcare domain, smart wearable devices can, for example, cater for remote diagnosis, medical prescriptions, and treatment of patients (Ghazal et al., 2021) or allow for the effective monitoring of public health (Trang et al., 2020). In the education domain, smart ICTs promote a more engaged learning experience in which learners can "learn at anytime, anywhere, in any way and at any pace" (Liu et al., 2017, p. 33). The importance of ICTs as a key driver for smart cities varies in the aforementioned application fields. In domains such as energy or transportation management, smart ICTs are essential enablers and require big data processing capabilities, while in domains such as education or public administration, smart ICTs have a more limited role where processing large volumes of data in real time is usually not required (Neirotti et al., 2014).

Apart of the relevance of ICTs to envision smart cities, a significant body of literature has argued extensively about

the importance of social, economic, and environmental needs of citizens (Chourabi et al., 2012; Dameri & Cocchia, 2013; Hollands, 2008; Marrone & Hammerle, 2018; Rosemann et al., 2021). In this human-centric view, citizens are put at the center of smart city development. They are considered to be the co-creators of smart cities, that is, citizens not only use services but also initiate and create relevant concepts for smart cities (Radziejowska & Sobotka, 2021).

However, along with the opportunities that smart cities bring, several challenges need to be addressed (Angelidou, 2014). For example, not everyone has equal access to digital technologies and rapid technological advancements can lead to further intensification of socioeconomic stratification. In addition, to tailor services to citizens, smart cities rely on vast amount of personal data, which raises data privacy and security concerns. The introduction of such invasive smart public technologies may even lead citizens to suspect conspiracies (Krämer et al., 2022). The implementation of smart city infrastructures is additionally complicated by the need to integrate different systems and the associated high investment and maintenance costs. Strategies to improve the quality of citizens' lives in smart cities focus specifically on improvements of social capital (strength of relationships among citizens), human capital (skills of citizens), citizen empowerment, intellectual capital (knowledge creation), participatory democracy, equality, diversity, and digital inclusion (Angelidou, 2014; Calzada, 2021; Chourabi et al., 2012; Dameri & Ricciardi, 2015; Nakano & Washizu, 2021; Shapiro, 2006).

For such strategies to be effective, smart city transformational projects and initiatives require a close integration of multiple stakeholders through strong governance mechanisms (Ruhlandt, 2018). General governance, according to Lynn et al. (2000, p. 235), refers to "regimes of laws, administrative rules, judicial rulings, and practices that constrain, prescribe, and enable government activity, where such activity is broadly defined as the production and delivery of publicly supported goods and services." Advances in ICTs have improved the governance capabilities in cities. For example, ICTs enable the efficient allocation of resources, foster collaboration and communication of rules and policies, or unleash social innovations (O'Reilly, 2011). ICT-based governance is also known as smart governance (Backus, 2001) and refers to the "collection of technologies, people, policies, practices, resources, social norms, and information that interact to support city governing activities" (Chourabi et al., 2012, p. 2292). The governing activities focus on interactions between government and citizens (G2C governance; e.g., providing citizens with personalized notifications and services or informing the government about citizens' concerns), government and businesses (G2B governance; e.g., identification of business partners or providing administrative and legal consultancy), and between governments (G2G governance; e.g., improving interoperability between government systems or managing government staff-related aspects) (Anindra et al., 2018; Bernardo, 2017).

Gil-Garcia et al. (2015) provide a characterization of smart governance based on three main building blocks: stakeholder engagement, ICT-based provision of services, and network-based relationships such as collaborations or partnerships. However, smart governance is a complex and multifaceted topic, and literature has extensively discussed various components, outcomes, measurements, and contextual factors (Bolívar & Meijer, 2016; Ruhlandt, 2018; Tomor et al., 2019). Smart governance components include, for example, roles and responsibilities of stakeholders; structures and organizations to effectively manage the interactions and partnerships between stakeholders (e.g., Bifulco et al., 2016; Bolívar, 2016; Dameri & Benevolo, 2016); processes related to information exchange, collaboration, decision-making, and implementation (e.g., Cano et al., 2014; Dimelli, 2016; Gil-Garcia et al., 2015; Pereira et al., 2017); technologies and data to enable effective governance (e.g., Castelnovo et al., 2016; Kourtit et al., 2017; Marek et al., 2017); and policy and legal frameworks to overcome challenges associated with smart cities (e.g., Bolivar and Chelvachandran et al., 2020; El-Ghalayini & Al-Kandari, 2020; Meijer, 2016; Razmjoo et al., 2021). Outcomes and related measurements address the technological, regulatory, economic, and social outputs including well-being, the degree of social and digital inclusion, number and quality of provided services, citizen engagement, available budget for smart governance initiatives, economic growth, and employment (Alsaid, 2021; Castelnovo et al., 2016; Herdiyanti et al., 2019; Ruhlandt, 2018). Different contextual factors that influence smart governance outcomes and components have been discussed in the literature, such as the degree of autonomy of smart cities or local conditions pertaining to demographics, administrative structures, economic conditions, or cultural aspects (Bolívar & Meijer, 2016; Meijer, 2016; Ruhlandt, 2018).

Overview of the special issue

Smart governance is a nascent research field, and it is of growing importance to understand the complexities associated with the design and implementation of effective smart governance mechanisms. This special issue leverages evolving developments in the smart governance field and aims to advance the understanding of innovative approaches to smart governance models for smart cities that may improve existing processes and models of governance as well as the interaction and communication between citizens and representatives of the public sector. Specifically, this special issue discusses how approaches and solutions enable enhanced

ways of information exchange and communication between citizens and representatives of the public sector, how new models can improve existing government models, and thus how urban knowledge can be preserved and used for future cities. While the special issue calls for rigorous research with a focus on smart governance, further topics of interest span, for example, learning and cognition theory for the implementation of smart cities, application of human-centered artificial intelligence for smart cities, digital platforms and ecosystems for smart cities, and data mining for smart city applications. The special issue comprises four papers covering various aspects of smart governance and providing initial insights into the issues associated with the emergence of smart cities.

This special issue includes four articles that cover different aspects of smart governance. Article 1 presents the concept of "City 5.0" as a new citizen-centric design paradigm for future cities. Article 2 discusses the role of design thinking (DT) principles to develop an innovative smart governance multi-actor collaboration strategy. Article 3 focuses on the determinants of rural smartness and its impact on the economic welfare of citizens in rural areas. The final article provides insights into the adaptation behaviors in the context of one-stop smart governance apps. The findings presented in the articles of this special issue provide promising opportunities for future research.

City 5.0: Citizen involvement in the design of future cities

The first paper in this issue, by Jörg Becker, Friedrich Chasin, Michael Rosemann, Jan vom Brocke, Daniel Beverungen, Martin Matzner, Jennifer Müller, Flavia Santoro, Adela del Rio Ortega, Manuel Resinas, Claudio di Ciccio, Minseok Song and Kangah Park (Becker et al., 2023), in press, proposes the "City 5.0" paradigm as a new citizen-centric design concept for future cities. Under this paradigm, City 5.0 is conceptualized as markets that connect providers of different public goods and services with citizens as consumers of these services. Providing citizens access to a range of public goods such as infrastructure, health care, and education in a barrier-free and nonexclusive manner is essential to enhancing the quality of life of citizens. The scholars propose and conceptualize four essential City 5.0 elements—namely constraints, livability, governance, and restriction management—and use the Entity-Relationship modeling technique to conceptualize their interrelationships. Constraints in the context of City 5.0 represent restrictions to public goods and services, which need to be eased to enhance the quality of life. Access to public goods or services may be restricted, for example, by the limited purchasing power of citizens, poorly designed services and goods that cannot be used by people with physical or mental disabilities, and geographical restrictions such as long travel distances between home and workplace. Additionally, a lack of awareness about and the availability of specific public goods and services are common barriers that can reduce the livability in a smart city. The scholars discuss five distinct categories of livability. First, the *stability, safety, and public governance* category encompasses basic public needs—protection from violence, traffic accidents, terror, and military and civil conflicts. To achieve this, effective public governance mechanisms are required (e.g., a fair justice system). Second, the *healthcare and social services* category relates to aspects of basic medical and social support services and facilities, including practitioners, pharmacies, childcare, community centers, post offices, and public toilets. Third, the *employment and economy* category is characterized by policies that support an entrepreneurial environment and is achieved through, for example, incentives for businesses or supporting employment. Fourth, the *infrastructure, housing, and environment* category refers to the infrastructural aspects of smart cities under consideration of environmental impacts, such as access to playgrounds and parks, well-established public transportation structures, advanced telecommunication networks, and affordable housing. Finally, the *culture and education* category encompasses the availability and barrier-free access to cultural, entertainment, and educational facilities. Governance mechanisms are required to manage the constraints, that is, identifying who is affected by which constraints and what is the impact of constraints on the different types of livability in smart cities. The scholars emphasize the need for collaboration between academic, professional, and public administration personnel and the citizens of smart cities. Also, technological solutions are required to foster this collaboration and to manage restrictions effectively. In this context, restriction management does not only apply to actual restrictions but also perceived restrictions. For example, individual security incidents in a generally secure smart city can impact the overall perception of security.

Design thinking collaborations in smart cities

Frederike Marie Oschinsky, Hans Christian Klein, and Bjoern Niehaves (Oschinsky et al., 2022), in the second paper, utilize design thinking (DT) principles to develop an innovative multi-actor collaboration strategy for fostering the governance of smart cities. Common DT principles such as radical collaboration, experimentation, and prototyping can strengthen the collaborative structures in smart cities and address common challenges related to the access, processing, and usage of data. The scholars emphasize a shift in governance from citizen participation ("being involved") to stakeholder collaboration ("working with partners"). While collaboration with different stakeholders allows the identification of innovative solutions to smart city challenges, it also requires appropriate strategies to involve and manage multiple stakeholders in the decision-making process and thus ensure the success of collaborative smart city projects. In the context of smart cities, the scholars identify three pillars of

DT that are critical to developing digital services through effective collaboration. First, multidisciplinary teams are required to effectively implement smart city projects. Teams consist of, for example, project coordinators who plan and monitor the project, thematic experts, citizens as users of the project outcome, or project sponsors. In addition, the scholars recommend utilizing skilled DT coaches to ensure that the DT techniques, tools, and processes are applied correctly. However, not all stakeholders should be involved in each phase of the project, specifically when previous attempts at cooperation with them were challenging, or significant efforts are required to upskill them. The second pillar refers to the processes underpinning the DT approach. In this context, the scholars recommend utilizing microplanning as a tool to manage project resources and milestones in each DT phase. In addition, different numbers of stakeholders should be included in each DT phase, requiring an agile project management approach. The scholars also stress the importance of including iterative feedback loops in each pillar to account for newly evolving challenges. The third pillar emphasizes specific requirements for workspaces. For example, the ease of use and usefulness of utilized tools for digital events should be optimized to ensure a positive collaboration experience and to avoid digital stress and distractions. Additional workplace strategies recommended by the authors include providing regular breaks and encouraging physical exercises in a digital work environment.

Rural smartness and impacts on rural economic welfare

Iqbal Yulizar Mukti, Jörg Henseler, Adina Aldea, Rajesri Govindaraju, and Maria Iacob (Mukti et al., 2022), in the third paper, focus on rural smartness, its determinants, and its impact on the economic welfare of citizens in rural areas. Rural smartness is characterized by the goal to improve the quality of citizens' lives in rural areas and to ensure sustainable economic growth through participatory governance and investments in human capital and IT infrastructure and services. The scholars argue that the adoption of smartness differs between urban and rural areas due to the different challenges that the two areas face. For example, urban areas encounter challenges related to high population density such as traffic jams, environmental pollution, and energy consumption, while rural areas are predominantly concerned with the lack of job opportunities and the resulting poverty and economic impact as well as inefficient business ecosystems. The scholars conceptualize four characteristics—namely connectedness, participatory governance, digital empowerment of citizens, and coherence of IT services provided—of rural smartness that positively impact the economic welfare in rural areas. First, connectedness describes the degree to which different stakeholders such as citizens, businesses, governments, and other third parties are connected through IT infrastructure and services. Second, participatory governance characterizes the degree to which stakeholders participate in governmental programs through the IT infrastructure and services provided with the goal of improving the economic welfare of citizens in rural areas. Third, the digital empowerment of citizens is characterized by their ability to develop innovative products and services using the IT infrastructure and services. Fourth, coherence of IT service provision characterizes the availability of a governmental strategy to provide relevant IT infrastructure and services. This strategy should be in alignment with the relevant goals and regulations for rural development. In addition, the scholars provide valuable insights into the determinants of rural smartness and their ability to transform the operational processes of rural ecosystems. These determinants relate to organizational, technological, and environmental readiness. Organizational readiness relates to the role of governments and their ability to initiate projects to realize rural smartness. In contrast to urban areas, rural areas are—from an economic point of view—often less attractive for private investors because of the lower purchasing power of rural citizens or the comparably higher logistics and transportation costs. Thus, governments can improve the connectedness between different stakeholders and the economic welfare of rural communities by making investments into the IT, logistics, and other infrastructure. In addition, governments have the power to initiate educational programs and also set incentives for collaborations with the private sector. Technological readiness relates to the supporting IT infrastructure and services that enable rural smartness. One critical technological resource for rural areas is the access to the Internet and the supporting infrastructure such as stable electricity supply. Broad access to fast Internet allows rural citizens to actively engage in rural development projects and make use of educational services. Environmental readiness relates to the role of citizens, third parties, and the regulatory environment in realizing rural smartness. One main challenge that needs to be overcome is that citizens require a certain degree of digital literacy and sufficient purchasing power to effectively access and make use of IT infrastructure and services. However, rural ecosystems are characterized by a collaboration of different interrelated stakeholders, and thus the government and other third parties such as educational institutions or the industry are required to provide the necessary services and infrastructures to enable rural connectedness. The scholars also provide valuable insights into the potential outcomes of rural smartness for rural areas. For example, apart from the perceived and actual economic welfare improvements by citizens, rural smartness can lead to higher levels of innovativeness through an increased rate of collaboration between businesses and higher entrepreneurial activities.

In addition, improved business performance through rural smartness can increase the competitive position of rural businesses. Such efforts can ultimately improve perceived welfare of rural citizens.

Adaptation behavior in using one-stop smart governance apps

Bingqian Zhang, Guochao Peng, Caihua Liu, Zuopeng Justin Zhang, and Sajjad M. Jasimuddin (Zhang et al., 2022), in the final paper of this special issue, focus on the mechanisms of citizens' adaptation behaviors in the context of one-stop smart governance apps. Such apps support the collection of real-time data about different smart city domains such as transportation, healthcare, and government services and thus enhance the monitoring capabilities of smart cities. In addition, they provide multiple services to smart city citizens in the form of an "all-in-one" solution and thus are a valuable tool for the governance of smart cities. However, while these apps aim to provide a broad range of services to all citizens in smart cities, there is a growing gap between the underprivileged members of smart cities such as the poor, elderly, or handicapped. Therefore, the scholars emphasize the need to develop strategies to address this gap. Specifically, the

Table 1 Research questions

Focus areas	Selected research questions
Information systems design for smart cities	• How can information systems help manage relevant constraints (e.g., accessibility, availability, or awareness) in smart cities? • What are the specific needs of digital immigrants and digital natives in smart cities and what are the resulting design and implementation implications for one-stop smart governance apps? • Which functionalities in one-stop smart governance apps are specifically relevant for digital immigrants and digital natives that enhance their perceived quality of life? • How can innovative concepts such as gamification enhance user engagement with one-stop smart governance apps? • What are the design implications for digital collaboration tools to enhance a positive collaboration experience in smart city projects? • What are the design implications of technology infrastructure and services in rural areas to enhance rural smartness? • How can the level of citizens' creative and innovation ability empowered by ICT services in rural areas be enhanced?
Participatory models and collaborative structures in smart cities	• How should collaborative structures be designed to manage constraints related to public goods and services (e.g., accessibility, availability, or awareness constraints) in smart cities effectively? • How do perceived and actual constraints in smart cities affect different aspects of livability? • How do alternative successful participatory models in smart city projects look like and how do they perform in different application contexts? • What are relevant measures and quantifiable outcomes for different design thinking stages in collaborative smart city projects? • What are the relevant skills needed for each stakeholder group to optimize the output of collaborative smart city projects? • How can relevant stakeholders be incentivized to become more involved? • How can improvements in digital literacy and access to ICT of rural citizens be achieved?

scholars investigate the different characteristics of adaptation behaviors of two user groups, digital natives and digital immigrants, to develop strategies to increase the engagement with one-stop smart governance apps. Digital natives represent citizens who are digitally literate and fluent with technologies, while digital immigrants struggle to navigate the digital world and commonly go through a challenging process of learning to use ICTs. The two groups have different adaptation behaviors toward one-stop smart governance apps, which require different strategies related to the development and implementation of these apps. The scholars identify three categories that characterize adaptation behaviors of citizens when using one-stop governance apps. First, technology exploration refers to citizens' behaviors of exploring and learning the features of an app to understand how owning the app might help fulfill personal needs. At this stage, digital immigrants tend to discover the features of the app by commonly relying on the help of others (e.g., friends and family) to explore and learn how to use the app. In contrast, digital natives are inclined to independently explore and learn the features of the app with the goal to improve their daily task efficiency. Second, exploitation category refers to the extent to which citizens and start using and adopting the features of the app to handle their daily tasks. The behavioral patterns differ between the two groups in this phase as well. Digital immigrants are generally more conservative in the usage of the app and usually repeat the previously learned steps to strengthen their confidence in using the app, while digital natives leverage their understanding of the app to further explore the features of the app to effectively manage their daily tasks. Third, the avoidance category refers to negative behaviors in terms of users stopping the use of an app due to a misfit between the user expectations with the app and actual experience. What both groups have in common is that they tend to stop using such apps when they experience negative emotions due to deficiencies in the app. The authors derive important design and implementation criteria for one-stop smart governance apps. For example, a positive emotional experience associated with the usage of an app is likely to be generated when user expectations regarding the quality of the system, information, and service are met.

Conclusion and avenues for future research

The rising number of people living in urban areas naturally brings an increase in societal, environmental, and economic challenges. Smart cities provide promising solutions for these challenges and thus have the potential to improve the quality of life for their citizens. However, to effectively create services that respond to the needs of citizens, effective governance mechanisms are required that support a close integration of multiple stakeholders. Considering the complex and multifaceted nature of smart governance, this special issue stresses the need for further exploration of key smart governance elements and their interaction. The four published articles provide valuable insights into the different dynamics of participative and collaborative structures in metropolitan and rural areas, responding to the recent call for more research on the contextual factors that underpin smart governance (Ruhlandt, 2018). Table 1 presents a set of research questions that we deem relevant considering the valuable insights produced by the published articles of this special issue and hope that they inspire researchers aiming to investigate this relevant topic.

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