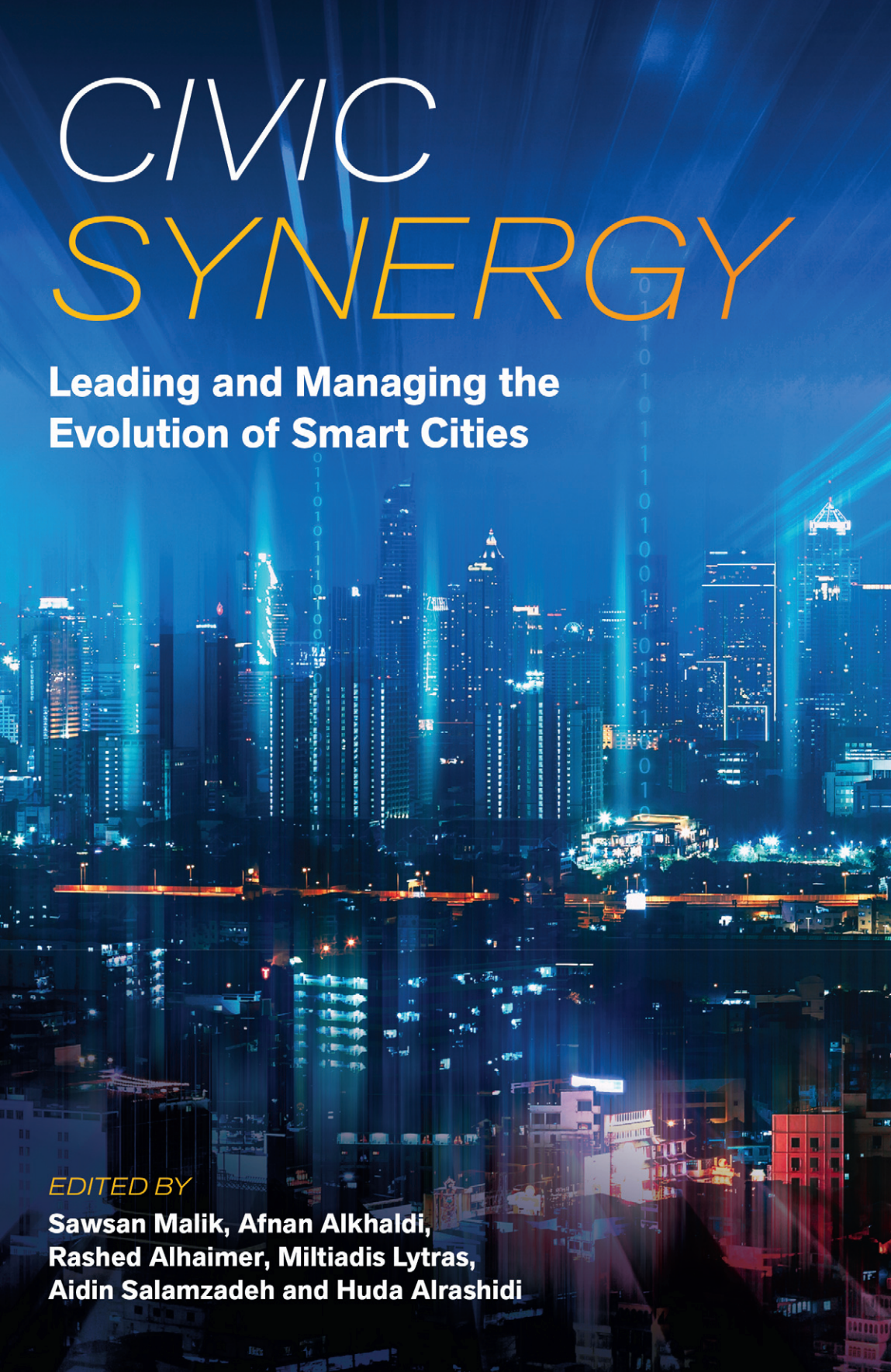
CIVIC
SYNERGY
Leading and Managing the Evolution of Smart Cities
EDITED BY
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Civic Synergy

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Civic Synergy: Leading and Managing the Evolution of Smart Cities

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About the Editors

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Dr. Afnan Alkhaldi is the Acting Dean Assistant of the Faculty of Business Studies at the AOU Headquarters. She is an expert in smart city development and previously served as a consultant for Kuwait's Al-Hareer Smart City project. Her work focuses on digital transformation, fintech and sustainable urban growth, driving innovation in economic development and urban planning.

Dr. Rashed Alhaimer is a highly accomplished academic and a thought leader with a PhD in Electronic Marketing from Brunel University London, a Master's in Business Administration and a Bachelor's in Management Information Systems. Former Dean of the Faculty of Business and Associate Professor at the AOU, Kuwait, Dr AlHaimer plays a pivotal role in shaping the academic and strategic direction of the institution. His professional journey also includes notable contributions in administrative and managerial capacities, particularly within the SME Support Department, where he demonstrated exceptional leadership and organisational acumen. Dr AlHaimer's research portfolio reflects a deep engagement with pressing global and regional issues, including the role of social media in political campaigns, public health communication, gender dynamics in enterprise performance and consumer behaviour during emergencies. His work, published in esteemed academic journals, underscores his commitment to addressing complex societal challenges through rigorous scholarship and evidence-based insights. A dedicated educator and mentor, Dr AlHaimer is actively involved in curriculum development, quality assurance and strategic planning initiatives. His collaborative approach and diplomatic leadership have earned him recognition, including the Excellence Award in Scientific Research. With a strong emphasis on fostering innovation and inclusivity, Dr AlHaimer continues to make significant contributions to academia, industry and the broader community, embodying the principles of intellectual excellence and social responsibility.

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Dr. Aidin Salamzadeh is the Vice Dean of the Faculty of Management at the University of Tehran and a business consultant at Arshanik. He has been listed among the top 2% of scholars in the field of business and management by Stanford University in 2024. His interests include startups, new venture creation and entrepreneurship. He serves as an associate editor for several well-known academic journals. Additionally, he co-founded the Innovation and Entrepreneurship Research Lab in London.

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About the Contributors

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Bedour Alboloushi is an Assistant Professor of Business Management at Kuwait College of Science and Technology. She holds a PhD in Information Studies from the University of Sheffield, UK, and a Master's in Business Administration. Her research centres on information systems, knowledge and innovation management. Dr Alboloushi has taught a variety of courses in information systems and project management in both Kuwait and the United Kingdom. In addition to her academic experience, she brings industry expertise from her role at the Central Bank of Kuwait (CBK). She has extensive expertise in management information systems and holds the Project Management Professional (PMP) certification from the Project Management Institute.

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Essa Almethen is a legal expert with over six years of experience specialising in financial technology, intellectual property, patents and contracts. As a Teaching Assistant at Kuwait International Law School, Essa is a key advocate for legislative advancements. His work ensures comprehensive social protection for vulnerable populations, making a significant impact in the field. Holding an LLM in International Commercial Law.

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I am **Khider Hamid Khider** from Sudan, living in Kuwait, and I have been working at an AOU for 19 years as a Lecturer in the business studies faculty; my interest areas of study and research innovation, entrepreneurship and sustainable development. I had two published articles, one about the knowledge-based economy in the Gulf region the second one about "Explaining and Predicting of Business Students' Continuance Usage of E-Learning: Direct and Mediating Process Model-Extending Technology Acceptance Mode. I would like to continue in the field of sustainable development and how it could affect the lives of human beings. The world today is moving to digital platforms and innovation, and this area is an interesting area for research which I would like to approach. Also, I had good experiences in the field of training and development as I participated in a number of workshops and training sessions in local organisations in the state of Kuwait.

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Preface

Civic Synergy: Leading and Managing the Evolution of Smart Cities explores the transformative impact of smart cities, focusing on the interplay between technology, governance and sustainability. This book brings together diverse perspectives, case studies and theoretical frameworks to examine the challenges and opportunities of urban innovation. From the Middle East to emerging economies, the chapters present key findings on how leadership, governance and technological advancements are shaping the future of urban living.

As cities grow and evolve, the need for sustainable and technology-driven solutions has become imperative. Smart cities leverage information and communication technologies (ICT) to enhance public services, improve infrastructure and increase citizen engagement. However, their development requires a careful balance between innovation, economic feasibility and social inclusivity. This book addresses these complexities by exploring a broad spectrum of themes, including digital transformation, open innovation, sustainable governance and the integration of emerging technologies such as blockchain, AI and fintech.

Through in-depth research and real-world case studies, Civic Synergy emphasises best practices and strategic approaches for developing smart cities that prioritise efficiency, inclusivity and sustainability. Each chapter contributes to a deeper understanding of how cities can adapt to rapid technological change while ensuring long-term resilience.

This book serves as a resource for policymakers, urban planners, scholars and industry professionals looking to bridge the gap between theory and practice. It provides actionable insights for overcoming challenges in smart city development while fostering a shared vision for progress. By examining successful case studies and offering practical recommendations, Civic Synergy provides a framework for building cities that are not only technologically advanced but also sustainable and inclusive.

Urbanisation and technological innovation continue to reshape the way we live, work and interact with our surroundings. As we navigate this transformation, the need for visionary leadership and collaborative governance has never been greater. This book underscores the importance of collective action in shaping cities that enhance quality of life, drive economic growth and promote environmental stewardship. We invite readers to engage with the ideas presented in this volume and contribute to the ongoing evolution of smart cities. The journey towards sustainable urban development is a shared responsibility, and this book highlights the power of innovation and collaboration in achieving this goal.

Chapter Summaries

Chapter 1: Closing the Loop: Can Circular Economy Concept Reduce Waste in Smart Cities?
Abdullah Alshemari

This chapter explores the potential of the CE concept to address waste management challenges in smart cities. By examining enablers and barriers to CE implementation, the study highlights the role of social, technological, legal, economic and environmental factors in promoting sustainable waste management practices.

Chapter 2: Developing a Theoretical Framework for Measuring Digital Transformation of Government Services in Kuwait
Nasser Alshawaaf, Basil Alzougool

This chapter presents a theoretical framework for evaluating the success of digital transformation in Kuwait's government services. Focusing on key metrics such as customer satisfaction, service quality and perceived security, the study provides actionable recommendations for enhancing digital service delivery.

Chapter 3: Digital Transformation in Islamic Banking: A Case Study of Boubyan Bank's Fintech Revolution
Dalal Aloumi, Salah Alhammadi

This chapter examines Boubyan Bank's integration of fintech solutions, showcasing how blockchain, AI and data analytics have transformed its operations and customer engagement. The case study offers valuable insights for financial institutions seeking to leverage technology for competitive advantage.

Chapter 4: Enhancing Urban Development: The Role of Open Innovation in Egypt's Smart Cities
Ahmed Rageh Ismail, Kholoud Fayed, Reem Essam, Shirley Nagy

This chapter investigates the impact of open innovation on Egypt's smart cities, with a focus on the New Administrative Capital. The study highlights the role of collaboration among stakeholders in driving sustainable urban development.

Chapter 5: How Fintech is Reshaping the Consumer Behaviour in the Modern Era: Evidence From Egypt
Reem Essam, Salma Aboualsoud, Rami Mohamed Farid

This chapter explores the transformative impact of fintech on consumer behaviour, emphasising the role of perceived ease of use, trust and financial literacy in shaping digital payment preferences.

Chapter 6: Innovative BESs for Sustainable Remediation in Smart Cities
Altaf Albaho, Shamsudeen Dandare, Rory Doherty

This chapter discusses the potential of BESs for environmental remediation in smart cities, offering case studies and research directions for integrating BESs into urban infrastructure.

Chapter 7: Navigating the Smart City Concept in Kuwait: Citizen Insights and Dimension Analysis
Basil Alzougool, Sumayya Banna

This chapter examines Kuwaiti citizens' perceptions of smart cities, using Giffinger et al.'s model to assess the importance of governance, mobility, economy and other dimensions in smart city development.

Chapter 8: Blockchain Technology (BCT) to Implement Sustainability in Innovative Export Supply Chains
Luai Jraisat, Christine Hattar

This chapter explores the use of BCT in sustainable supply chains, offering a conceptual framework for leveraging BCT to enhance sustainability performance in exporter–importer partnerships.

Chapter 9: Envisioning the Future of Smart Cities: Marketing, E-Branding, and the Role of 'Pace'
Ahmad Salem D. Ghazi

This chapter highlights the importance of e-branding and marketing in smart city development, offering recommendations for aligning smart city initiatives with Kuwait Vision 2035.

Chapter 10: Leveraging Smart Technologies for Value Creation and Competitive Advantage in Startup Companies: Insights From Emerging Economies
Jumana Nalakam Paramba, Aidin Salamzadeh

This chapter investigates how startups in emerging economies use smart technologies like AI, blockchain and Internet of Things (IoT) to create value and gain competitive advantage.

Chapter 11: Role of AI-Based Training Towards Achieving Sustainable Organisational Performance via Mediation of Employee Engagement
Sura I. Al-Ayed

This chapter examines the impact of AI-based training on employee engagement and organisational performance, offering insights for integrating AI into training programs.

Chapter 12: The Role of Islamic Finance in Achieving Sustainable Development Goals: A Conceptual Framework for Smart Cities and Urban Development Projects
Islam Kamal, Ahmed Rageh Ismail, Omar Dewidar, Moamen A. Shazly

This chapter explores the potential of Islamic finance instruments in supporting sustainable urban development, offering a conceptual framework for aligning Islamic finance with the Sustainable Development Goals (SDGs).

Chapter 13: Regulating Kuwait's Fintech Revolution: The Legal Implications of InsurTech
Mohammad Alkandari, Bedour Alboloushi, Essa Almethen

This chapter addresses the regulatory challenges of InsurTech in Kuwait, offering recommendations for strengthening the legal framework to support innovation in the insurance sector.

Chapter 14: Decision Support and Early Warning Systems for Effective Crisis Management Towards Sustainable Smart Cities.
Danah Al-Enezi, Ali Al-Dousari, Abdullah Al-Enezi, Ahmed Hassan, Ohoud Al-Enezi

This chapter proposes an integrated decision support system for managing natural hazards in Kuwait, emphasising the role of AI and GIS in enhancing urban resilience.

Chapter 15: AI-Driven Smart Classroom Innovation and Creative Thinking Skills: Review of Implementing STEM Programme
Meshari Abdulhameed Alsafran, Yousiff Awad, Shaimaa Nasser Rabiah, Mudhi ALmansour

This chapter explores the role of AI-driven smart classrooms in fostering creative thinking and STEM education, offering a research paradigm for future innovation in education.

Chapter 16: Using X for Smart City Marketing in Kuwait: Lessons From Qatar's TASMU Programme and Singapore's Smart Nation
Yousra Elkhashab, Abeir Saad

This chapter examines the role of smart city marketing in enhancing urban services, with a focus on lessons from Qatar and Singapore for Kuwait's smart city initiatives.

Chapter 17: The Influence of Moderating Sustainable HRM Practices With Training on Job Performance in the Private Sector in Kuwait
Anwaar Alkandari, Ahmad Alsaber, Berlanti Odeh, AbdulWahab Baroun, Bedour Alboloushi, Rania Nafea.

This chapter investigates the impact of sustainable HRM practices on job performance, emphasising the moderating role of training in enhancing employee productivity.

Chapter 18: The Role of Job Satisfaction in Organisational Commitment at Dentistry Services in Kuwait: Insights for Integration With Smart Cities
Anwaar Alkandari, Rania Nafea, Shaikhah Alainati, and Ahmad Alsaber

This chapter explores the relationship between job satisfaction and organisational commitment in Kuwait's dental sector, offering insights for integrating smart city principles into healthcare services.

Chapter 19: Evaluating the State of Art in Smart Cities Development: The Case of Greek Local Government
Chris Mantas, Sifis Plimakis, Vassilis Karapetsas, Sawsan Malik

This chapter assesses the progress of smart city initiatives in Greek municipalities, highlighting challenges and opportunities for advancing urban innovation.

Chapter 20: Libraries in the Smart City Ecosystem: Driving Sustainable Development Goals Through Digital and Community-Centric Approaches
Haya Albader, Abeer AlSubaie

This chapter examines the transformative role of libraries in smart cities, offering a strategic framework for aligning library services with the SDGs.

Chapter 21: Sustainable Urban Governance: A User-Centric Approach to Visual Pollution Management in Smart Cities
Haya Albader, Khaled Alrasheed, Abeer AlSubaie, Naser Alselahi

This chapter proposes a user-centric mobile application for managing visual pollution in smart cities, emphasising the role of crowdsourcing and IoT in enhancing urban aesthetics.

Chapter 22: Business Students' Perspectives on the Synergy Between the Triple Bottom Line and the Entrepreneurial Ecosystem in the Kuwaiti Market

Khider Hamid Khider, Mohammad Fuhaid Sager Alajmi

This chapter investigates the Economic Dimension of the Triple Bottom Line (TBL) and its role in sustainable entrepreneurship within Kuwait's entrepreneurial ecosystem. It emphasises the need to balance profitability with social and environmental responsibilities and examines how this balance fosters innovation, investment and long-term business success.

Concluding Remark

Civic Synergy: Leading and Managing the Evolution of Smart Cities is a testament to the power of collaboration, innovation and shared vision in shaping the future of urban living. By exploring the intersection of technology, sustainability and governance, this book offers a roadmap for building smart cities that are not only technologically advanced but also socially inclusive and environmentally sustainable. We hope this volume inspires further research, collaboration and action towards creating cities that enhance quality of life for all.

Recommended Reading

Alkhaldi, A. (2022). Digital exclusion during the COVID-19 pandemic: A review of how developed countries responded to support their citizens. *Journal of Electronic Government Research*, *2*(1), 1–15.

Alkhaldi, A., & Alrashidi, H. (2024). Investigating the service quality factors that influence the use of Sahel service in Kuwait. In *Innovation and technological advances for sustainability* (pp. 123–140). Taylor & Francis Group.

Alkhaldi, A. N., Alrashidi, H., Alhassan, K., & Alsadeeqi, A. (2023). The use of blockchain technology to build smart cities: Creating public value in Kuwait. *Journal of Global Knowledge, Memory, and Communication*, *12*(3), 45–60.

Alkhaldi, A., Malik, S., Alhammadi, S., & Lytras, M. D. (2024). *The role of government in ensuring sustainability in smart urban development: A case study of Kuwait*. Emerald Publishing Limited.

Alkhaldi, A., Malik, S., Alhaimer, R., Alshaheen, A., & Lytras, M. D. (2024). Translating a value-based framework for resilient e-learning impact in post-COVID-19 times: Research-based evidence from higher education in Kuwait. *Heliyon*, *10*(2), e12345.

Lytras, M. D. (2023). Future smart cities research: Identifying the next generation challenges. In *Smart cities and digital transformation: Empowering communities, limitless innovation, sustainable development and the next generation* (pp. 1–11). Emerald Publishing Limited. https://doi.org/10.1108/978-1-80455-994-920231001

Lytras, M. D., Alkhaldi, A., & Malik, S. (2024). *A holistic framework for smart cities governance in the Gulf region: From hype to sustainable impact*. Emerald Publishing Limited.

Lytras, M. D., Alkhaldi, A., & Malik, S. (2024). Transformative leadership and sustainable innovation in higher education: Setting the context. In *Transformative leadership and sustainable innovation in education: Interdisciplinary perspectives* (pp. 211–229). Emerald Publishing Limited.

Lytras, M. D., Alkhaldi, A., Malik, S., & Serban, A. C. (2024). *Artificial intelligence for smart city vision 2040 in the Gulf region*. Emerald Publishing Limited.

Lytras, M. D., Alkhaldi, A., Malik, S., & Serban, A. C. (2024). Transformative learning for future higher education: The artificial intelligence-enabled learning revolution 2035. In *Digital transformation in higher education, Part B* (pp. 231–241). Emerald Publishing Limited.

Lytras, M. D., Alkhaldi, A., Malik, S., Serban, A. C., & Aldosemani, T. (2024). *Visioning the future of higher education through artificial intelligence*. Emerald Publishing Limited.

Lytras, M. D., Alsaywid, B., & Housawi, A. (2023). Digital transformation and smart cities: Insights from the healthcare domain. In *Smart cities and digital transformation: Empowering communities, limitless innovation, sustainable development and the next generation* (pp. 319–325). Emerald Publishing Limited. https://doi.org/10.1108/978-1-80455-994-920231015

Lytras, M. D., Housawi, A. A., & Alsaywid, B. S. (2023). *Smart cities and digital transformation: Empowering communities, limitless innovation, sustainable development and the next generation*. Emerald Publishing Limited.

Lytras, M. D., & Şerban, A. C. (2020). E-Government insights to smart cities research: European Union (EU) study and the role of regulations. *IEEE Access*, *8*, 65313–65326. https://doi.org/10.1109/ACCESS.2020.2982737

Lytras, M. D., Serban, A. C., Alkhaldi, A., Aldosemani, T., & Malik, S. (2024). Digital transformation in higher education in times of artificial intelligence: Setting the emerging landscape. In *Digital transformation in higher education, Part A* (pp. 1–22). Emerald Publishing Limited.

Lytras, M. D., Serban, A. C., Alkhaldi, A., Malik, S., & Aldosemani, T. (2024). *The AI landscape in higher education: Current developments, opportunities, and threats*. Emerald Publishing Limited.

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. 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*, *56*, 102224. 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*, *56*, 102146. https://doi.org/10.1016/j.ijinfomgt.2020.102146

Lytras, M. D., Visvizi, A., & Jussila, J. (2020). Social media mining for smart cities and smart villages research. *Soft Computing*, *24*(15), 10983–10987. https://doi.org/10.1007/s00500-020-05084-3

Lytras, M. D., Visvizi, A., Sarirete, A., Torres-Ruiz, M., & Daim, T. U. (2021). IEEE access special section editorial: Future generation smart cities research - Part II: Services, applications, case studies, and policymaking considerations for well-being. *IEEE Access*, *9*, 27298–27303. https://doi.org/10.1109/ACCESS.2021.3057809

Lytras, M. D., Visvizi, A., Torres-Ruiz, M., Damiani, E., & Jin, P. (2020). IEEE access special section editorial: Urban computing and well-being in smart cities: Services, applications, policymaking considerations. *IEEE Access*, *8*, 72340–72346. https://doi.org/10.1109/ACCESS.2020.2988125

Malik, S., Alkhaldi, A., Al Mansour, J., & Lytras, M. D. (2024). *Digital intersections: Synergies between the gig economy and evolution of the smart city*. Emerald Publishing Limited.

Mantas, C., Karapetsas, V., & Malik, S. (2024). *The contribution of Green tourist development on sustainability and entrepreneurship in rural areas of Greece. Securing a Sustainable Future through Blue and Green Economies*. IGI Global publishing. Chapter 21 https://www.igi-global.com/book/securing-sustainable-futures-through-blue/349580

Mantas, C., Karapetsas, V., & Malik, S. (2024). *The Usage of AI in the public sector: The case of Greece and proposals for future research. Education, Future jobs and Smart systems in the Age of Artificial Intelligence*. Emerald Publication.

Marouli, C., & Lytras, M. D. (2018). Smart cities and internet technology research for sustainable and inclusive development: An integrated approach of best practices for policymakers and educators. In *E-planning and collaboration: Concepts, methodologies, tools, and applications* (Vols. 1–3, pp. 434–458). IGI Global. https://doi.org/10.4018/978-1-5225-5646-6.ch021

Nikiforova, A., Flores, M. A. A., & Lytras, M. D. (2023). The role of open data in transforming the society to Society 5.0: A resource or a tool for SDG-compliant smart living? In *Smart cities and digital transformation: Empowering communities, limitless innovation, sustainable development and the next generation* (pp. 219–252). Emerald Publishing Limited. https://doi.org/10.1108/978-1-80455-994-920231011

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Chapter 1

Closing the Loop: Can Circular Economy Concept Reduce Waste in Smart Cities?

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Abstract

Maintaining a sustainable waste management is a challenge for development of smart cities amid the current global urbanisation. As cities worldwide embrace sustainability as a key driver of future growth, waste management is crucial not only for environmental health but also for promoting public well-being. The concept of circular economy (CE) focuses on keeping resources and never wasted. There are significant enablers of and barriers to the implementation of CE practices in urban contexts. This paper aims to identify the enablers of and barriers to implement CE principles in smart cities to reduce waste and promote circularity processes in waste management. A comprehensive literature review was conducted to examine waste generation points, current disposal systems and the application of the CE concept to waste management in smart cities. The research indicates that different methods contribute to waste production in urban areas, all of which could benefit from the CE concept. These ideas provide a foundation for various sustainable waste management practices. The research findings highlight the significance of social, technological, legal, economic and environmental factors for the adoption of CE concept and suggest a framework towards changes, consideration and towards waste circularity in smart cities.

Keywords: Smart cities; circular economy; sustainability; waste management; smart cities waste

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Introduction

Smart cities have been developed as a revolutionary scheme for urban development and management in a time of rapid urbanisation and technological advancement (Adeolu Adenekan et al., 2024). Recent reports indicate a prominent global trend towards smart city initiatives. According to the recent market analysis, the worldwide smart cities market is projected to grow at a compound annual growth rate of 9.72% from 2024 to 2029 (Statista, 2024).

A smart city aims to maximise resource utilisation, enhance citizens' quality of life and improve overall urban service efficiency by leveraging digital technologies and data analytics. Smart cities are metropolitan communities that use data-driven solutions and smart technologies to address the complex problems of urban living (Kaiser, 2024). This entails the use of Artificial Intelligence (AI), big data analytics and Internet of Things (IoT) sensors to create networked systems that enable real-time control and monitoring of city services (Gatti et al., 2024). The integration of technology into city infrastructure enables improved management of resources such as water, energy and waste. Moreover, the benefits of smart cities include (Gatti et al., 2024; Kaiser, 2024):

- *Enhanced quality of life:* Smart technologies raise living standards for locals.
- *Economic development:* Smart cities may attract firms, provide employment and promote economic development by improving efficiency and innovation.
- *Sustainability:* Reducing carbon footprints and managing resources effectively, smart cities encourage sustainable habits.
- *Citizen engagement:* Technology makes it possible for more people to participate in governance, which makes decision-making processes more transparent and responsive.

Different countries particularly developing countries have shown different approaches to urban development by investing a large amount in smart city projects. For example, Singapore has established itself as a leader in urban innovation by investing over $2 billion in developing digital infrastructure and undertaking many smart city initiatives under its well-known Smart Nation programme (Singapore Smart Nation, 2023). In a similar vein, Songdo, South Korea, is a prime example of a significant investment in smart urban development. Songdo's projected expenditure of around $40 billion indicates the nation's goal of establishing a fully integrated smart city environment (Lee et al., 2022). These investments exemplify the global trend towards the integration of smart technologies in urban environments to improve sustainability, efficiency and quality of life.

Depending on the size of the project and the priorities of the country, different amounts of money are needed to construct smart cities. Over the past 10 years, Barcelona has invested over €500 million in smart technology initiatives, with a focus on boosting energy efficiency and strengthening transport systems (Demir, 2022). The transition to smart cities is an appropriate response to the intricate

issues that have arisen as a result of growing urbanisation, sustainability and the rapid advancement of technology. The opportunity for improved urban living conditions and environmentally friendly methods is growing as nations worldwide engage more in smart technologies, thereby supporting the development of resilient and effective urban ecosystems (Gatti et al., 2024). This trend demonstrates the significance of strategic financial investments in achieving the goal of smart, sustainable cities.

The Concept of Circular Economy (CE)

The CE is a sustainable and progressive strategy to resource management that aims to promote closed-loop operations, improve resource efficiency and minimise waste (Ellen MacArthur Foundation, 2024). The 'take, use, dispose' method typically leads to resource depletion and environmental harm; in contrast, CE promotes a regenerative strategy that seeks to extend the lifespan of materials, products and resources. This goes beyond simply reducing waste, with the objective of entirely reforming how resources are used, valued and ultimately maintained within an economy (Alshemari et al., 2020). CE promotes a shift in approach towards applying the 3R concept (reduce, reuse and recycle) to establish a circularity model that addresses the decline of the environment and shortages of resources. The three R's aim to create a sustainable environment that prioritises human health and society (Alshemari et al., 2020).

CE practices promote recycling, renewable energy and resource utilisation in order to benefit both human health and society as a whole. As the world's population grows, cities expand and environmental concerns increase, the necessity for a shift to a circular approach becomes more critical (Alshemari et al., 2020). CE is becoming more widely used in a variety of industries, including manufacturing (Geissdoerfer et al., 2022), healthcare (Alshemari et al., 2020), agriculture (Rauw et al., 2022) and the food industry (Rabbi & Amin, 2024), because they have the potential to be both sustainable and profitable.

Smart cities offer the comprehensive infrastructure and data analysis required for the effective application of CE principles. Smart technology makes it easier to measure resource flows, allowing communities to monitor consumption patterns and identify places where efficiency may be improved. Tracking is crucial to establishing a more transparent and efficient CE where materials are reused and repurposed instead of being discarded. The attempts not only facilitate the efficient use of resources but also provide wider economic advantages, such the generation of jobs in environmentally related fields and decreased municipal operating expenses, thereby laying the groundwork for a sustainable urban future (Kannan et al., 2024).

This research aims to identify the factors that enable or hinder the application of CE in smart cities. In order to accomplish this aim, the following process was adopted. The sources of urban waste production were identified through the analysis of the literature in order to analyse current waste management

techniques, identify safe disposal methods and determine whether improved waste management and reduction in smart urban environments can result from the use of CE principles.

Methodology

A detailed narrative of existing literature on smart city waste management was conducted to examine how the principles of the CE can enhance smart cities waste. These methods assist the identification of different viewpoints and interpretations in previous studies and enrich the paper by providing a more comprehensive understanding of the CE concept application in smart cities. The main concepts found during a preliminary literature review served as the foundation for the creation of the analysis framework. A specific process was established and adhered to, complete with criteria for choosing keywords and phrases. By identifying the primary research gaps, defining important theoretical concepts, key words were searched for. The primary search used the following keywords: 'Smart cities AND Smart bin AND Smart cities waste' OR 'Waste management' OR 'municipal solid waste' OR 'Recyclable waste' OR 'recyclable waste collection' OR 'Circular Economy' OR 'Circular Economy Principles'.

To identify the inclusion and exclusion papers, each article's titles and abstracts were first reviewed. Next, relevant abstracts were identified, and the full texts of these articles were obtained. The papers that were eliminated after selection are listed below. Only English-language publications and papers published before August 2024 were taken into consideration. The search employed various databases, including Elsevier, Google Scholar, MDPI, PubMed, SAGE and Science Direct. Computerised databases were used to conduct the search instead of human searches. Furthermore, a search for non-academic grey literature was conducted using related keywords on Google. This included news, reports and webpages about smart cities, smart cities' waste and CE.

Articles and papers that address smart cities, waste management in smart cities and/or CE and that provide fresh and pertinent insights were included in the literature review. Studies that addressed methods for improving waste management, cutting waste production, and applying CE principles were also taken into consideration. Papers that did not directly address these keywords were excluded. The purpose of this study was to collect a wide variety of evidence, spanning all pertinent techniques and studies to build in-depth literature data.

Results

Waste Creation Points in Smart Cities

Waste creation in smart cities is influenced by a variety of variables, including consumer behaviour, industrial activity, population increase and the increasing use of digital devices. Particular strategies are needed to reduce the consequences of each sector's unique contribution to the overall waste problem (Do Livramento Gonçalves et al., 2021). For instance, whereas residential areas usually produce enormous volumes of municipal solid waste, commercial and retail locations

contribute significantly to packaging waste. Industrial activities bring hazardous waste, and building and infrastructure development can produce large volumes of construction debris. Public utilities and services generate operational and electronic waste, while transportation systems generate waste from infrastructure wear and vehicle maintenance. Table 1.1 sheds light on the complexities involved in waste management within smart cities.

Table 1.1. Waste Creation Points in Smart Cities.

Source of Waste	Concern	Current Approach	Source
Residential areas	Lack of recycling participation	There is a rise in landfill waste since many households do not participate in recycling programmes because they are confused or unaware of them.	Ferronato and Torretta (2019)
	E-waste management	Since many technological devices include hazardous elements, improper disposal of them can have a negative impact on the environment.	Jain et al. (2023)
Commercial and retail spaces	Excessive packaging	The majority of the materials used in packaging being non-recyclable, the growth of e-commerce has led to a substantial waste problem.	Syed Ali et al. (2024)
	Food waste	Large volumes of leftovers are thrown out because many firms lack efficient food waste control plans.	Syed Ali et al. (2024)
Industrial activities	Inefficient waste management	Industries frequently produce large amounts of waste with little effort spent on recycling or recovery, which has an adverse effect on the environment.	Srivastava et al. (2022)

(Continued)

Table 1.1. *(Continued)*

Source of Waste	Concern	Current Approach	Source
	Regulatory challenges	Effective management procedures may be hampered by having to navigate complicated hazardous waste rules.	Srivastava et al. (2022)
Construction and infrastructure	Construction waste management	Large amounts of building waste frequently end up in landfills as a result of limited recycling possibilities.	Al-Raqeb et al. (2023)
	Decommissioned infrastructure	Disposing of old structures may be difficult, especially when dangerous chemicals have to be handled securely.	Bertino et al. (2021)
Transportation systems	Pollution from traffic	Vehicle emissions increase with increased urbanisation, exacerbating problems with air quality and public health.	Bikis (2023)
	Inefficient transportation logistics	Ineffective logistics planning can result in needless waste and emissions when moving cargo.	Ikpe and Shamsuddoha (2024)
Public services and utilities	Wastewater treatment	Increased urban population growth may put a strain on wastewater treatment plants, contaminating the environment.	Xiao et al. (2024)
	Energy inefficiencies	Smart devices do not always function at their best, wasting money and energy.	Xiao et al. (2024)

Table 1.1. *(Continued)*

Source of Waste	Concern	Current Approach	Source
Data and digital waste	Data overload	Smart device data build-up that is not needed can make analysis more difficult and result in inefficiencies.	Xiao et al. (2024)
	Obsolete technology	It can be difficult to control the digital waste produced by frequent changes to hardware and software.	Vishwakarma et al. (2022)
Urban agriculture	Organic waste management	Disposal problems may arise due to the lack of urban agricultural infrastructure for both composting and recycling biological waste.	Manea et al. (2024)
	Soil and water pollution	The soil and streams in urban areas may get contaminated due to improper handling of agricultural waste.	Manea et al. (2024)

Source: Compiled by Author.

Waste is rapidly increasing in urban areas, which emphasises the need for efficient waste management systems that put the environment's best interests first. Conventional waste management practices frequently depend on inflexible schedules that integrate manual collection with segregation and recycling duties, resulting in inefficiencies and overuse of resources (Hajam et al., 2023). One major problem is a lack of infrastructure; communities cannot efficiently manage waste if they do not have appropriate facilities and procedures for waste recovery, recycling and collection (Hajam et al., 2023). It is imperative that these issues be resolved if smart cities are to achieve their environmental objectives and become more sustainable.

Waste Management in Smart Cities

Proper waste management is a crucial element of urban efficiency and environmental sustainability in smart cities. Smart cities are utilising IoT devices, data

analytics and real-time monitoring systems to optimise waste collection and processing as metropolitan areas continue to expand (Szpilko et al., 2023). For example, sensor-equipped smart bins can detect fill levels and communicate with waste collection providers, improving route efficiency and reducing needless collections. This approach lowers operational costs and mitigates the environmental impact of collecting trucks' emissions and fuel consumption (Szpilko et al., 2023). Additionally, a many smart cities have strong recycling programmes that are supported by public education initiatives aimed at increasing involvement, increasing recycling rates, and reducing the quantity of waste sent in landfills (Fang et al., 2023). However, because these technologies require reliable infrastructure and are expensive, they may be difficult to implement in some communities with limited resources. Furthermore, low recycling and waste reduction programme participation might exceed the advantages of technological waste management developments, which mostly depend on community support and public awareness (Fang & Shan, 2023; Szpilko et al., 2023).

To promote material recycling and lessen the environmental effect of manufacturing activities, the industrial sectors of smart cities employ state-of-the-art monitoring systems to assess the production of waste and implement strict regulations (Srivastava et al., 2022). By facilitating the recycling and reuse of materials, smart logistics and waste tracking technologies help reduce the quantity of waste that ends up in landfills. Based on real-time traffic data, waste collection routes are optimised to minimise delays and emissions from waste collection vehicles, hence providing benefits to transportation systems (Olawade et al., 2024; Srivastava et al., 2022).

Waste Disposal

The use of digital waste management systems enhances these initiatives by enabling continuous tracking and data-driven decision-making that optimises collection routes and resource allocation (Hussain et al., 2024). The diverse disposal techniques employed in various nations are shown in Table 1.2.

The techniques mentioned above demonstrate the range of approaches smart cities are employing to effectively manage waste, reduce its adverse environmental impacts and promote sustainability. Every city adapts its plans to fit its unique needs, available resources and technological prowess. For instance, cities worldwide, especially those in the Gulf Cooperation Council (GCC), are implementing novel disposal methods that enhance waste management practices while placing a high premium on resource recovery and environmental health (Almokmesh et al., 2024). By expanding the use of cutting-edge waste-to-energy plants and community recycling initiatives, the GCC is showcasing its dedication to sustainable practices. By employing state-of-the-art technologies for waste collection and sorting, these cities are improving public health outcomes and minimising their environmental impact. They are also creating cleaner urban environments (Alkhaldi et al., 2024; Lytras et al., 2024).