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A Systematic Study on the Integration of Smart City Technologies in Urban Planning and Governance in Europe

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Abstract

Purpose: The research examines how well innovative city technologies work in European town planning and management systems. This paper evaluates the implementation of integrated technologies starting from the 1990s to achieve social, environmental and economic targets in European cities.

Materials and Methods: The researchers use the DEMATEL (Decision-Making Trial and Evaluation Laboratory) approach as part of the multi-criteria decision-making methodology to study dependencies between various thematic components of smart cities. The process constructs a diagram that visualizes cause-and-effect connections by receiving assigned threshold values.

Findings: The research outlines technology, innovation, structure, life, environment, education, training, governance, and enga, which are not the core thematics in innovative city management. Establishing sustainable cities depends heavily on social cohesion, urban infrastructure, entrepreneurship systems, and healthcare infrastructure. To succeed, all innovative city initiatives need the focus elements of governance and engagement, education, training, and mobility.

Unique Contribution to Theory, Practice and Policy: For European cities to achieve smart city technology, they need to focus on governance, education combined with training, citizen engagement, the path to su, and development.

Keywords: *Smart City Technologies, Urban Planning, Governance, Internet of Things (IoT), Sustainability*

INTRODUCTION

Global trends in urban development have fashioned new conditions for sustainable development by creating both opportunities and challenges. World statistics show that 30% of the worldwide population resided in cities in 1950, yet this number expanded to 55% in 2018, and experts predict it will increase to 70–75% by 2050 [1]. The rapid spread of cities consumes natural resources while breaking down vital ecosystem systems, creating significant obstacles to transportation, waste management, supplying energy, and delivering education and housing [2]. European cities encounter specific challenges because dense populations interact with their urban structures, which have developed in the past. European metropolitan areas are implementing innovative city technologies to face challenges as they integrate advanced systems that enhance planning operations and management. The study evaluates innovative city technology's effects on European urban planning through educational, safety, and public management assessment while delivering sustainable development guidance for cities.

Cities have evolved into complex systems because the worldwide urbanization boom demands fresh management solutions. Multiple regions experience disorganized urban growth, which causes their cities to face persistent challenges in delivering waste management, transportation infrastructure, and energy services [4]. Urban planning systems using traditional practices lack the capability to manage contemporary urban frameworks at their proper scale, leading to operational problems and environmental damage. Modern cities require better tools to manage their data while distributing resources properly since their growing resource requirements meet increasing ecological challenges [2]. The current worldwide developments immediately require establishing innovative urban management systems that focus on sustainability and resilience.

European societies experience rapid urbanization, which follows worldwide patterns yet operates within a framework defined by regional social values and economic goals supported by environmental standards. European urban areas experience intense demands to preserve their excellent lifestyle standards as they tackle increasing energy consumption, transportation problems, and rising waste output [3]. Urban systems present sophisticated requirements requiring coordinated solutions to establish fair arrangements between social equity, environmental safeguards, and economic progression. The strategic incorporation of technology has become essential for sustainable development because European cities establish their framework first while other metropolitan areas grow organically without plans [5]. During city expansion, Europe has pioneered advanced urban planning methods that address emerging population growth challenges.

The rise of the Internet of Things (IoT) innovative city technologies allows European urban areas to implement sustainable, efficient urban systems for addressing current challenges. The main aspects of innovative city initiatives consist of smart living combined with economy and governance and environment and energy and mobility domains [44]. By combining IoT technology and data-enabled systems, cities achieve more efficient energy consumption while building better transportation networks, increasing public security, and minimizing environmental dangers [42]. Intelligent energy management systems operate through optimized resource use, while intelligent transportation systems reduce carbon emissions and traffic jams [7]. These technologies support merging public entities with private entities, thus allowing cities to provide sustainable services while enhancing their quality of life [5]. Modern cities function as engines for economic growth by backing new technology ventures which use resource-friendly business solutions [6]. Implementing innovative technologies within urban planning structures makes European cities establish connected operating systems that preserve resources and provide better living conditions for citizens.

European cities still face significant barriers when applying smart city technology effectively for urban development. Research on smart cities has focused on individual aspects like IoT applications and energy efficiency. Yet, systematic analysis is needed to understand the successful interactions between smart living and economy sectors with governance domains, environmental and energy features, and mobility management that shape urban outcomes, according to [41, 60]. Integrating innovative technologies by public and private entities alongside universities requires further examination in the European region because regional directives and urban building histories heavily influence such partnerships [43]. The study covers these two gaps by examining how innovative city technologies can be strategically deployed across thematic areas for enhanced urban planning. The findings from this research benefit three groups: urban planners, policymakers, technology developers, and others, who all require knowledge to build sustainable and resilient urban environments that promote equity.

The research investigates European urban planning improvements through smart city technology assessments, which involve thematic analytical reviews and evaluation of stakeholder participation. The research analyzes library study outcomes in five sections to evaluate digital tool integration in urban operations, specifically related to education services, safety procedures, and public information systems management [41, 60]. Part 1 of this work introduces the research topic, followed by findings from the literature review in Parts 2 through 4 before Part 5 synthesizes primary conclusions for smart city project implementation. This research will present an extensive approach European cities can use to handle population growth and maintain sustainable development alongside social balance.

LITERATURE REVIEW

Urban development has shifted into thoughtful city planning to manage population growth better as it expands cities. Special technologies allow innovative city development to transform from basic urbanization using Information and Communication Technologies to make digital networks and livable places. Innovative city technologies enable cities to make improved decisions using simulation modelling while adjusting operations and projecting future changes. This research studies how European cities apply innovative city technologies to tackle urbanization problems, specifically in Santander, Spain, and London, UK. It discusses their results and difficulties alongside scalability and compatibility with Industry 5.0 and the United Nations SDGs.

Smart cities use Information and Communication Technology, AI technology, and IoT devices to handle city resources better and improve local leadership and citizen welfare [10]. Data-based and citizen-led systems let urban managers run operations more efficiently [47]. With IoT technology, urban managers receive live traffic data and manage electricity better to provide a higher standard of living [11]. Under Industry 5.0 principles, human-machine relationships drive sustainable technology adoption to protect communities and the planet while boosting the economy according to SDG 11 targets. For smart city improvement to succeed, government institutions, private companies and citizens must work together to set up innovative transportation systems, healthcare programs, and new ways to use energy and protect the environment and public safety [10, 46].

Case Study 1: Santander, Spain-The Smart Santander Project

The Smart Santander testbed project in Santander, Spain, leads cities worldwide by deploying 20,000+ sensors to build an innovative urban network [12, 13]. Through augmented reality, the SmartSantander app lets users know about transportation options, traffic conditions, parking spaces, and public services near them right now [12, 14]. The sensors track environmental conditions like noise level and pollution and track parking spaces to decrease traffic and make

the air cleaner [10, 21]. Different researchers worldwide can test Internet of Things algorithms through its open platform to develop new solutions [11, 13]. The system enhances traffic flow and decreases driving time by monitoring parking spaces and offering available spot data. This results in a yearly 2,400-ton CO_2 emission decrease across similar setups. Public services operate better and save money from waste to street lights because of their connected data systems [5]. The public strongly interacts with the app, which helps them access more services [14]. Expanding sensor networks becomes harder because the servers that manage data need intensive processing [4, 11]. People feel unsafe when personal location information is collected, so strong data security measures are essential to build confidence [4, 14]. Despite receiving EU funding for specific projects, the project faces a key problem because the eleven million grants will not work for other locations without special financing [14]. Technical issues arose when combining multiple IoT devices into a single platform [11, 20] and needed constant system updates. Santander found its testbed model workable for cities of mid-size populations, which provided city governments with real backing, but additional money and technology support still need to be solved [13]. Several other cities should follow how Santander brought together stakeholders, including the University of Cantabria, Telefonica I+D, and the local government, to deliver projects that suited local needs [10, 21]. Cities should focus on developing privacy protocols alongside open systems to boost adoption and growth, yet they need consistent funding for operational sustainability [4, 14].

Case Study 2: London, UK-Smart Mobility Initiatives

London connects smart cities with transportation solutions through partnerships between public and private organizations [13, 57]. The WebCAT online tool shows people in London all transportation options and trip times, whereas the Oyster Card allows users to access all city buses and trains, Underground trains, Thames boats, and Santander Cycles bike rentals. Traffic zones detect problematic traffic patterns to improve urban efficiency while reducing environmental pollution [57]. Modern transportation solutions in London help people reach their destinations better and cut down traffic because traffic dropped by 15% in centre city areas since 2003 through congestion charging [57]. The Oyster Card system makes it easy for people to pay their transit fees, leading to doubled transport usage annually [13]. WebCAT enables users to make better trips because it gives real-time traffic information. These programs support SDG 11 by allowing people to travel safely in urban locations. Transport for London and other private organizations cooperate to make new technologies work on a large size [57]. Maintaining digital systems costs businesses a lot of money and forces government departments to keep putting funds into the technology [57]. Some residents, including poor members of society, cannot use innovative technology tools like WebCAT because of digital access restrictions. Public demands for better data privacy remain high even though mobile tracking systems collect much traffic and user information [19]. Implementing bike-sharing and congestion charging outside Manhattan needs operational and political support [57].

London demonstrates a model for large cities with effective transport systems but needs financial backing and local political leadership to work properly [57]. London's payment technology platforms and planning insights can be added to different cities while installing digital access solutions for everyone in these areas [19]. Successful implementation of urban technology depends on effective governance partnerships such as the one between TfL and its stakeholders [57]. When data handling remains open to view, it solves privacy problems, which builds trust from the public [19]. The new industrial revolution combines urban planning with AI and IoT systems to boost resource distribution and decision-making while making local systems perform better [15, 17]. Urban data processed by AI creates predictions for city planning purposes, while IoT links monitor and deliver services directly to support SDG 11

goals [19, 48]. SDG 13 guides innovative grid development to cut energy usage as Ascot's intelligent transport system decreases emissions, according to research from No. 15 and No. 19. The need for comprehensive control systems appears to counter the emerging AI transparency and data privacy problems. Using Industry 5.0 principles, European cities form alliances with stakeholders while building stronger sustainability and resistance in local administration, as shown in Santander and London [15, 46].

Our research must follow specific methods to study the effects of innovative city technologies on space and time [17]. Research frameworks must gather and process data before planning teams decide how to use them [17]. Santander provides the best proof that using experiments to refine IoT applications brings real benefits [11]. The city of London shows how decision-makers should involve residents and work openly to make data-based mobility plans work [57]. Monitored applications of modern technology demand coordinated leadership to build strong cities that grow economically and protect their residents. Organizations and institutions should collaborate to create linked, innovative city systems [16, 46]. European cities like Santander and London use technology to solve urban development issues while following Industry 5.0 practices and working towards SDG 11 [19, 48]. The SmartSantander project illustrates IoT benefits yet faces scalability and privacy limits, showing how organizations and private companies need better collaboration in open platform development [11, 14]. While London achieves system-wide mobility solutions through public-private partnerships, digital inclusion barriers stand in their way, plus expenses are hard to handle [57]. Research-based policies using innovative technology data will improve our way of living while enhancing our economy and making cities more ready for challenges.

MATERIALS AND METHODS

This study employed a systematized literature review as a methodology in addition to a cross-sectional analysis. To address complex problems, the DEMATEL (Decision-Making Trial and Evaluation Laboratory) method was used to examine the findings, a structured approach that allows researchers to generate new scientific insights [18]. This was done because it can identify and analyze the interrelationship between other factors involved in the integration of smart city technologies in urban planning and governance within Europe.

The methodology, which is structured in a seven-stage methodological approach, was followed for the research framework. The list of stages designed was such that each stage would provide a broad and rigorous review of the issue. A theoretical foundation was established in the beginning with an extensive review of existing literature. Next, a cross-section study was performed to obtain necessary information about smart city implementation in various European urban settings. Finally, the DEMATEL method was applied to analyze the cause-and-effect relationship among essential variables to improve the understanding of how innovative city technologies affect urban planning and governance.

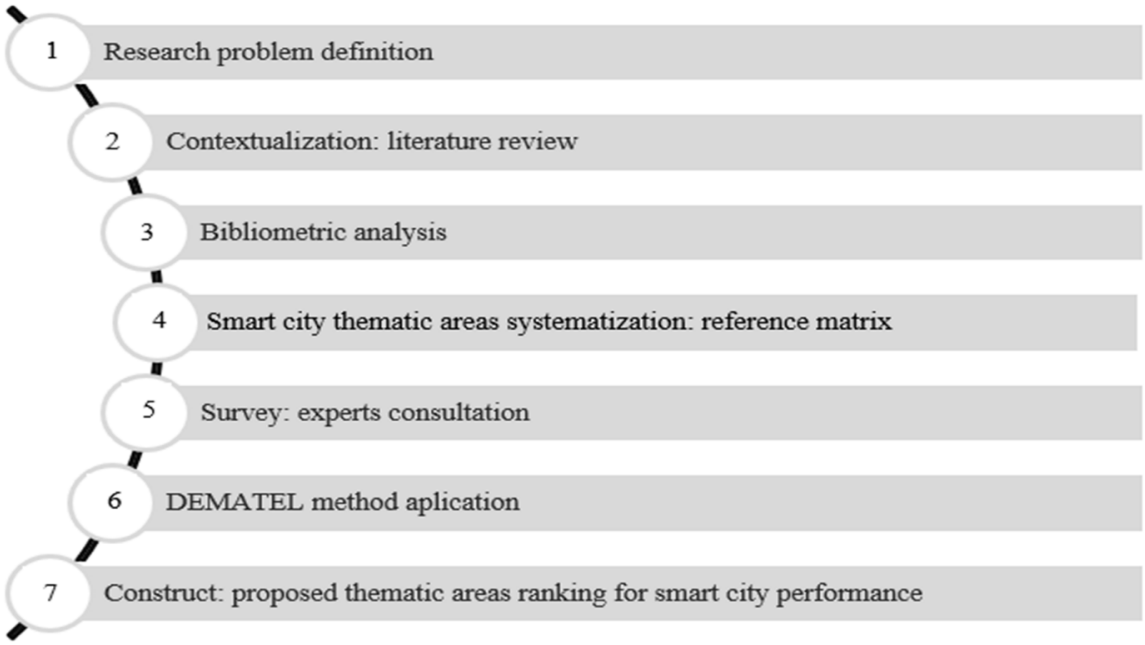

Figure 1: Methodological Research Diagram

The study starts by defining the research problem to provide direction and structure to the subsequent stages. At this stage, the main two issues to figure out are how to understand the problem purely and which factors lead to that problem. Forming the research question for the study is a fundamental part of this stage. This research strives explicitly to answer how institutional and physical arrangements associated with smart cities enhance or undermine urban planning and governance in European cities.

In the second stage, a solid theoretical foundation is created to guarantee that conceptual clarity is clear and that research on the topic is comprehensive. It includes an in-depth study of the different components of smart city technologies and the participation in urban planning and governance of smart city technologies. Appropriate academic literature was selected from respectable databases (Scopus, Web of Science) to carry out this. These sources also enable the study to be framed in a well-supported academic context and a clear understanding of the research that is currently underway on the integration of smart city technologies in the European urban environment.

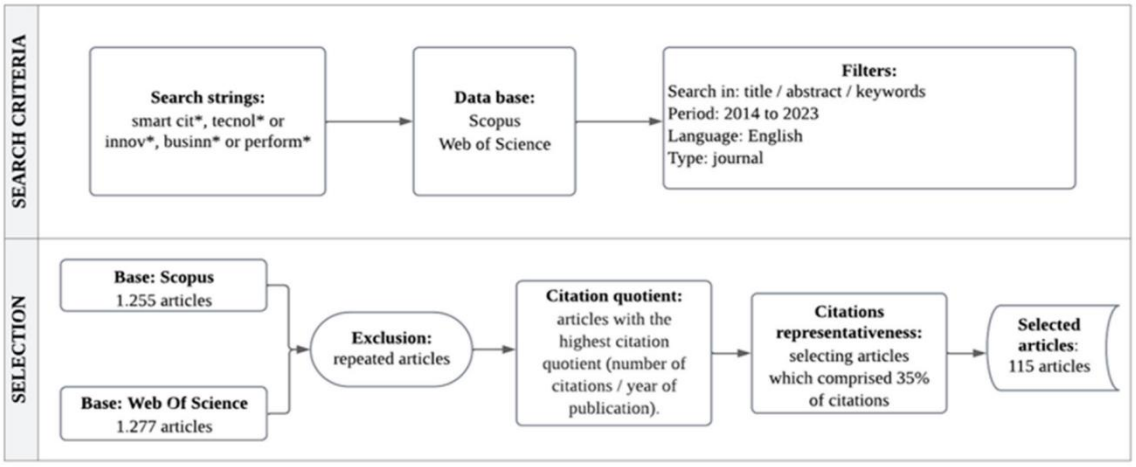

Figure 2. Database Review Protocol

A structured methodology was employed to select relevant, high-quality research articles in a systematic review of integrating innovative city technologies in European urban planning and governance. Search strings were first defined and used on two widely known academic databases, Scopus and Web of Science. Twenty-five hundred thirty-two articles were returned for these searches. To refine the dataset, duplicate articles were removed, leaving 956 cases of duplicate studies deleted. Therefore, the remaining 1,576 articles were first subjected to the first selection process.

Most importantly, the citation impact of each article was the main selection of criteria at this stage. To address this, I calculated the citation number concerning the article date, and it would cycle based on the articles date that had the impact. A secondary selection criterion, citation representativeness, followed this ranking. After selecting an article based on accounting for 35% of total citations, only 115 articles were further analyzed.

The selected studies' information was categorized systematically to address multiple attributes, including author, title, source, and year of publication, number of citations, keywords, target audience, and thematic area. By categorization, this method enabled us to wrap the conceptual knowledge around and approach it in a more structured way, thus allowing us to set ourselves up for bibliometric analysis. The keywords were grouped and structured into clusters using keywords, with a minimum frequency threshold of 30 mentioned in the text trained. Likewise, any terms deemed not pertinent to innovative city technologies and urban governance were handled to maintain the appropriateness of the analysis.

In the fourth stage, a thematic analysis was conducted regarding the most often occurring keywords in the co-occurrence mapping. Analyzing the relationships between these keywords, the thematic core of smart city integration in urban planning was de-syndicated. Next, a reference matrix was created based on segments of thematic areas into 11 pertaining categories. These categories were based on urban space management and the production of innovative smart city solutions in public services.

The fifth stage involved an exploratory survey to obtain an expert perception of the interdependencies of the areas of interest. The paired factor analysis used in this survey was intended to evaluate the influence levels of thematic areas. An 11 multiple-choice question structured questionnaire has been developed, which correlates with a specific thematic area. They asked respondents to assess the influence that each of the 10 thematic areas had on and received from the remaining 10 thematic areas. The five-point scale on which the response options were structured was 0 (no influence), 1(low influence), 2 (medium influence), 3 (high influence) and 4 (very high influence). It was distributed to researchers on innovative city technologies, municipal public administrators, professionals in the technology sector, and business managers developing technology.

Finally, in the sixth and last stage, the DEMATEL methodology was used to analyze the interdependencythematic areas' interdependencies. First, this technique was employed to discover the cause-and-effect relationships between thematic areas and was helpful in decision-making on issues related to urban governance. A structured, hierarchical approach based on expert input is used in the DEMATEL to identify the influence between thematic areas. These relationships were quantified with the help of a relational matrix and vector calculations. This methodology contains five phases. Here, an expert response was developed in the first phase, drawing interconnections between the 11 thematic areas through a direct influence matrix. The second stage normalized this matrix by applying a normalization factor (k) and noting it according to specific equations. By standardizing the comparison of influence levels across thematic areas, this normalization provided this.

$$X = k.A$$

$$k = \frac{1}{max_{1 \le i \le n} \sum_{j=1}^{n} aij}, i, j = 1,2,\dots,n$$

In the third phase of a systematic study of integrating innovative city technologies in European urban planning and governance, the total relationship matrix T was constructed to analyze the potential dependence among different factors within the total set of relationships. In the beginning, it was formulated that the identity matrix III be equivalent to the elements of the normalized matrix. Equation (3) systematically derived the total relationship matrix T from this identity matrix, which was the core of the total relationship matrix T. In this framework, T represents the total relationship matrix, and III represents the identity matrix, which both play pivotal roles in describing the interactions and linkages in studying innovative city technologies in European urban governance.

$$T = X(I - X)^{-1}$$

Phase four continued to add rows and columns to the total matrix T so that the vector D, summing each row, and vector R, the sum of each column, could be computed. Here, t is the element on the third row and j column in this context. Following Equations (4)-(6), these calculations were conducted to provide a full assessment of data distribution across the matrix.

$$T = [\, tij \,]_{nxn}, i, j = 1, 2, \dots, n$$

$$D = \left[\sum_{j=1}^{n} tij \right]_{nx} = [\, t_i \,]_{nx1}$$

$$R = \left[\sum_{j=1}^{n} tij \right]_{1x} = [\, t_i \,]_{1xn}$$

FINDINGS

In this regard, the results of this study were organized to answer the research question and presented systematically based on the literature review and bibliometric analysis of smart city technologies in urban planning and governance in Europe. Data from experts and a proposed ranking of the thematic areas relevant to evaluating the performance of smart cities were introduced into the analysis.

A reference matrix was created through a comprehensive literature review and bibliometric analysis of how word co-occurrence is related to smart cities' technology implementation, which determined a potential list of identified critical thematic areas essential for a smart city's technology strategic implementation. Eleven basic thematic regions are summarized in this matrix, and they must serve as the driving forces for innovative urban planning and governance strategies in European cities. These are the thematic areas where effective integration of innovative city technologies improves efficiency, sustainability, and general urban management.

Table 1: Smart City Thematic Areas Reference Matrix.

Thematic Area	Description	References
Governance and Engagement	Thus, it sought to generate management strategies around the use of assistive technologies in public services to make these activities available in a digital format, reducing processing time and engaging the population who would standardize such activities.	[6,38]
Mobility	Sustaining and affordable urban mobility efforts are aimed at reducing travel time con, congestion reduction, and pollutant emissions.	[35,45]
Health and Assistance	The new public health policy strategies involve analyzing and mapping the population conditions through automated diagnostics and providing mechanisms for optimizing public health outcomes using these municipalities.	[46,47]
Security and Protection	Technological tools are being used to track location activities, and security systems, such as lighting control, are being used to improve processes in remote management.	[35,36]
Technology and Innovation	The use of information and communication technology helps city planning. Processing is simplified, and solutions that will actually improve urban space are developed.	[37,44]
Living environment and Infrastructure	It lies in the conditions, interactions, and activities on a healthy planet, where all the factors should balance coexistence in a society focused on quality of life and sustainability.	[18,35]
Coexistence and Reciprocity	It sets standards for navigation, presence, and providing public spaces for citizens under conditions, setting up signage and other interventions to ease presence in public spaces.	[35,36]
Economy and Sustainable Consumption	It creates access, movement, and assistance standards for citizens within public areas, such as signposting and support services.	[18,37]
Education and Training	Propose solutions for increasing the level of education all over the region in terms of the availability of educational institutions, technological infrastructure, and digital tools used in primary and higher education.	[38,39]
Entrepreneurship	The development of technology parks, numerical evolution of regional companies, creative economy actions, and other such enterprise operations.	[40,41]
Energy	Proposed for improvement in energy resources, diversification of the local energy mix, and alternatives for strategic use of renewable energy sources.	[42,43,44]

Europe-wide research into city planning and governance shows that different innovative technology areas work together to develop better urban planning methods that benefit city

residents. Multiple urban domains must communicate effectively to achieve brilliant city success when improving urban spaces with these solutions [19]. Our society sees technology and innovation as the main drivers of improving different industries' performance. Energy management systems that use the Internet of Things technology give remote controls to urban lighting systems and help achieve better energy efficiency while saving money and protecting the environment [20]. The networked system allows the use of energy more effectively while making operations cheaper.

European smart cities bring sectors together well by tracking water quality. The city's officials and citizens can quickly monitor water quality and improve health outcomes and resource operations thanks to digital tools [23]. These developments show how technologies benefit from combined efforts between technology innovation and areas of the environment and city infrastructure operations [22, 50]. Smart technology adoption in European cities depends on how well their urban governance frameworks combine technology innovation and the living environment. Putting innovative city systems into European city planning and leadership makes cities better for people and more sustainable and effective. Our examination points out essential smart city technology fields that boost success while explaining how they enhance public administration, transportation, learning, defence, energy consumption, economic development, healthcare, and city structure.

Governance and Public Engagement in Smart City Management

Cities in Europe work toward innovative management by involving people in important decisions and making public information available while partnering with private companies [24]. Digital platforms help people efficiently use public services and let citizens react to government decisions immediately while taking part in city planning decisions [25, 51]. Big data analytics helps public officials develop better policies by finding the best use of resources and addresses the differences in how governments and citizens work with each other [26]. The City of Vienna manages the Smart City Wien initiative through WienBot to help citizens contact services, report district concerns, and give comments about public policies through a smartphone app. Between January and December 2022, WienBot and public users accounted for a 20% jump in urban matters, which was solved within 48 hours [27]. Effective digital management exists, although we need to address older people's digital literacy issues. Governance frameworks vary across Europe. Scandinavian cities, especially Copenhagen, put open data first by letting people access 80% of their municipal data, but this system needs strong cybersecurity protection [19]. Southern European cities like Lisbon emphasise participatory apps yet struggle to expand participation because their residents use digital technology at low rates [20]. Each local area requires customized security and access solutions because the studies show this pattern [24]. Digital tools help people connect more, but they deny participation to individuals who cannot use technology. Vienna operates effectively because its population understands digital technology well, which not every area can achieve with poor infrastructure development. Combining digital and face-to-face operations creates a better opportunity to include everyone, as study results indicate [25].

Education, Digital Learning and Smart Training Solutions

Technological education becomes essential for smart cities to create effective online platforms. Smart cities in Europe provide online study tracking and custom-tailored learning schedules through their network platforms [27]. Learning platforms help market-ready programs match skills with digital tools that let parents see what their children learn [28]. Helsinki, Finland, relies on Education Cloud to enable students to customise digital learning tools and AI systems to update their programs based on individual performance feedback [24]. During 2023, online

instruction benefited 90% of students who learned math better by 15% than regular teaching methods [22]. The Amsterdam Smart City Academy trains professionals in AI and IoT for 2,000 graduates who found technical work in 2023, according to Amsterdam Smart City. The digital learning platform of Helsinki offers tailored educational solutions yet needs substantial funding that prevents its use in smaller metropolitan areas. Amsterdam runs successful training programs for skilled tech workers, although they do not serve everyone who needs help finding jobs. Research reveals that including job training would help the initiative reach more individuals [28].

Urban Mobility and Intelligent Transportation Systems

Many European urban areas experience transportation problems, including traffic jams, environmental pollution, and poor quality of transportation structure. Innovative city technologies that track traffic in real-time and do predictive analysis, plus use automated systems, help run operations smoothly and sustainably [29]. Simulation technology helps arrange traffic flows and builds support for bus and bike travel [30]. Herrenberg Germany: The city utilizes the SUMO Simulation of Urban Mobility to develop traffic models and lets AI forecast congestion while improving public transportation routes [36]. Using models in 2022 improved bus passenger numbers by 10% while reducing carbon emissions by 5% when allocating road space to bikes and automatically switching traffic lights [25]. In cities, innovative parking technology helps drivers find their parking spots 20% faster and allows vehicles to move more easily [29]. The Intelligent Traffic System in Copenhagen, Denmark, has decreased traffic delays by 15% in 2023 because its AI system manages traffic signals through IoT sensors. The program connects bike-sharing rides with real-time data and predicts the best times for users. Data shows that system users made 1.2 million journeys 2023 through this system. The SUMO system from Herrenberg suits small cities yet needs top-quality input data, which presents an obstacle to implementation. The Copenhagen setup works well with expanding needs but needs ample financial resources to establish itself. Research demonstrates that small cities achieve good results with single biking solutions like lane additions, yet large cities must use multiple connected tools. The two models encounter the same issue caused by government rules against adding autonomous vehicles.

Energy Efficiency and Sustainability in Smart Urban Planning

European cities focus on making buildings consume less energy using renewable energy sources, tracking systems, and updated operation procedures. The intelligent grid system cuts energy waste, and energy certification systems verify the sustainability of built infrastructure [31, 52]. Stockholm, Sweden, uses smart grids to run energy checks throughout the Royal Seaport district through solar and wind power systems. The research found that the monitored area within this innovative grid system used 30% less energy while making 40% fewer emissions from traditional electricity systems by 2023 [27]. Specialized equipment screens building energy performance through distant observation to ensure the standards remain in place [32]. Stockholm succeeds due primarily to public financing and strong public support, although such support might not exist in other resource-constrained zones. The solar projects throughout Lisbon demonstrate that smaller-scale setups need time to deliver equal impacts to Stockholm. Achieving scalability depends on finding ways to pay for computer systems and physical upgrades [31].

Security, Surveillance and Risk Prevention Strategies

Smart cities improve security systems by using artificial intelligence to monitor crime patterns and threats, which helps their fast-response teams react faster [33]. Both physical emergency responses and digital protection systems keep buildings safe and protected [34]. The Crowd

Monitoring System in Amsterdam, Netherlands, employs AI and Internet of Things sensors to watch public spaces, reaching a 12% lower crime rate in 2022 [31]. Data prediction tools helped police departments focus resources on dangerous places before crimes happened [33]. Surveillance in Amsterdam proved effective but made its residents uneasy, with 30% expressing discomfort [34]. Comparative analysis of Barcelona's less intrusive sensor-based security shows trade-offs between efficacy and public trust. Data handling rules in governance systems need to become clear and accessible to everyone [34].

Economic Development, Entrepreneurship and Digital Transformation

Smart cities develop economies through business technologies and start-ups that use big data analytics, AI, and blockchain systems to run operations better [35, 53]. Electronic market platforms and new government services attract investors and employees [36]. The e-Restidency Program of Tallinn Estonia allows foreign entrepreneurs to set up digital businesses, which is expected to reach 100.000 members by 2023 [32]. Blockchain technology enhances transaction security, leading to a 5% increase in performance annually [30]. The digital economy in Tallinn works because of top-level e-governance systems, while smaller cities operate with limited digital infrastructure. Support from Dublin start-up community data shows that physical incubators need digital systems to help more start-ups succeed [35].

Healthcare Innovation and Smart Medical Solutions

European innovative healthcare systems enable medical monitoring from a distance and allow faster detection of conditions, plus safe data exchange that helps lower hospital workload [37, 54]. Blockchain technology shares private medical records more securely through telehealth, where anyone can get medical care from remote locations [38]. Barcelona, Spain, operates Health 4.0 through IoT, which monitors patients at home and decreases hospital visits by 15% in 2023. 85% of users in Blockchain find their patient data protected through this technology [33]. The internet connection speed in rural areas of Barcelona is a barrier to reaching success in healthcare. Studies prove that small telehealth programs succeed, but digital education programs are needed to assist those facing digital inequality [37].

Technology, Innovation and Urban Infrastructure Development

Modern city development relies on technology to connect the Internet of Things (IoT), artificial intelligence (AI), and sensors, which boost service quality and environmental protection [39, 55]. Advanced building monitoring plus waste and water systems build stronger cities [40]. Through IoT sensors, Portugal's city of Lisbon adjusted its waste collection routes to cut costs by 25% in 2023 [37]. Artificial intelligence in water management systems continues to save 10% of water through sustainability measures [39]. The Lisbon systems work well for medium-sized cities and require a significant initial capital investment before use. Stockholm's IoT integration techniques can guide cities with limited budgets as they take their initiatives step-by-step for implementation [40]. Trimmed local governments across Europe reveal new ways of urban administration through regular community interactions in Vienna combined with educational technology in Helsinki and Herrenberg's virtual traffic experiment. The evaluation process shows how digital access problems and privacy threats impact IoT systems, plus how different institutions handle their IoT projects differently across European nations. European cities that unite technology solutions with inclusive plans will make their urban development sustainable and resilient [24, 39].

CONCLUSION AND RECOMMENDATIONS

Conclusions

Smart cities use modern technologies and Internet of Things systems to help city planners do their work better while making municipal departments work more efficiently to build better urban spaces. Our study examines how innovative city technology reduces European city management to make better data-based choices. Analyzing smart city interactions among city leaders and technology with citizen participation shows how these methods boost urban area living standards. These integrated technologies help our cities better manage resources and customer services and create a more sustainable environment that encourages both new business development and digital business progress.

Our research looked at expert studies and statistics to determine how smart cities should be managed and built. It diagrammed these thematic parts to find how smart urban strategies impact several aspects of urban management. Since digital governance and urban transformation are essential for Europe, our research helps modern debates about sustainable city planning by showing how smart technologies improve governance performance.

The researchers used DEMATEL (Decision-Making Trial and Evaluation Laboratory) to study smart city topics. They evaluated expert opinions through a detailed matrix system to determine how one theme influences or depends on another and find their direct impacts. The team used data to produce a cause-effect diagram that placed the 11 thematic areas into four functional groups: central, Determining, Independent, and Impact factors.

European cities employ Governance, Engagement, Education, and Mobility to deliver business benefits from smart city operations. These organisational areas serve as familiar and critical bases of urban modernization and the first person in public policy. More often than not, innovative infrastructure projects will be a key factor in municipal decision-making about such projects, which are usually focused on energy protection and safety value. Independent Elements: The individual ones comprise economic stability, healthcare fulfilment, business venture practices, and community involvement. These pieces have much potential for development due to intelligent urban leadership methods. Core elements support Technology and Innovation as well as Living Environment and Infrastructure because the latter two require central management. Educational and mobilization plans should be linked to the progress of urban development.

The study developed strict importance and influence measures for these topics before arranging them in a ranked structure that shows their relationships within innovative city governance. European cities now plan and run their operations more successfully through smart city technology integration. Innovative city projects enhance operations by smartly managing resources and improving living conditions when IoT data and digital management are appropriately deployed. Sustainable urban development depends on building all aspects of smart cities, including effective leadership and transportation systems, education, and public safety. To support this research, citizens have shown how involvement in technological advances helps governments adapt their rules effectively. Cities throughout Europe now use data to make better decisions while making their cities more operational and more resistant to threats. Cities must create a whole city system to plan smartly by including all people and ensuring their developments meet sustainability requirements.

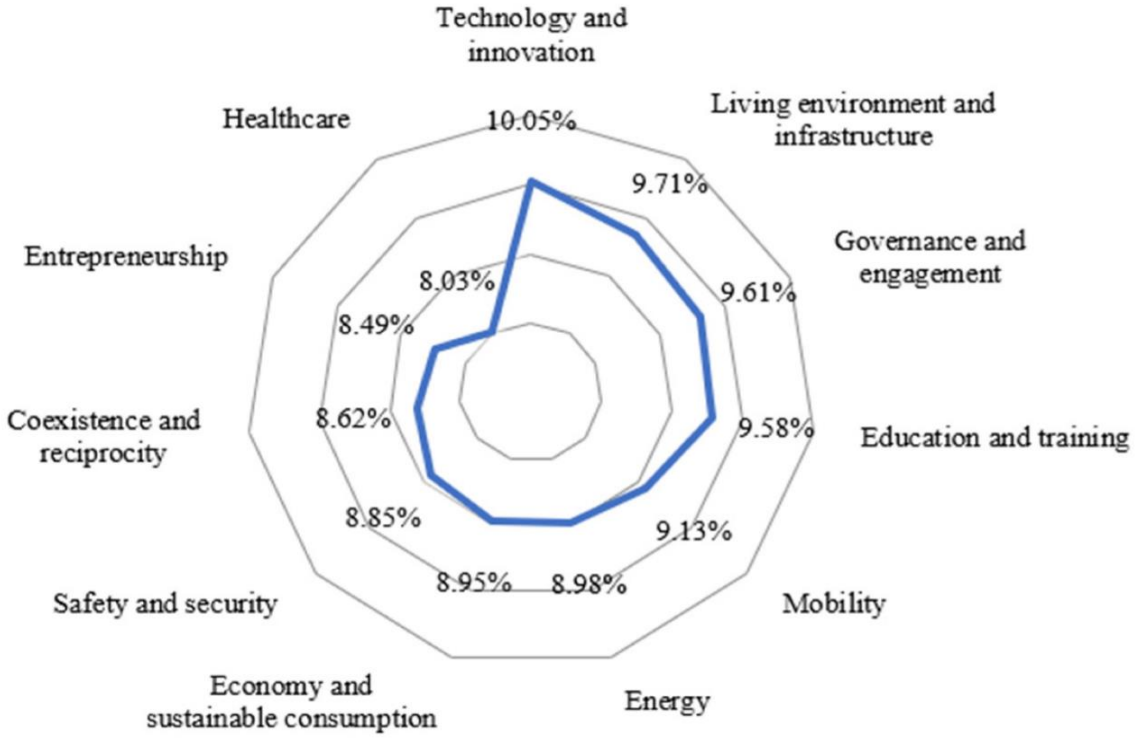

Figure 3: Thematic Areas' Hierarchical Ranking Diagram

Integrating innovative city technologies in Europe's planning and governance has significantly influenced various thematic areas. In Ere precisely, technology and innovation were leading at 10.05%. This dominance reflects technology's significant effect on urban service infrastructure to make cities efficient and sustainable. The next following are the living environment and infrastructure, which is 9.71, showing that those factors that provide the quality of life in the urban area are crucial. These services directly affect residents' daily lives, and their immediate impacts can be seen in the urban space. At 9.61%, governance and engagement come in third for the role of strategic urban service management in encouraging interdependency between the municipal authorities and the public. Education and training account for 9.58% and play a significant role in preparing diversified audiences for the rising urban landscape and creating knowledge and skills in sustainable city development. Furthermore, despite ranking lower, other thematic areas can play essential roles in shaping urban environments and play a part that should also be accounted for in the design and planning of smart cities.

To make innovative city initiatives scalable in the field of economic and social development, there is a need to have a structured approach that is countable with the broader vision of urban sustainability. Implementation is successful if public administrations, private sector entities, educational institutions and citizens are coordinated. This collaboration allows for the adaptation of technological solutions to local settings specific to various regions through integrating urban sites. However, urban spaces differ in variety, and urban space is rapidly growing in population while technology continues to develop. Almost equally problematic is the lack of established indicators for the measurement of performance of innovative city governance and technological implementation, which, in turn, limits the ability to evaluate if progress has been achieved, as well as compare the results among different urban areas.

The United Nations defines urban sustainability as a critical issue, and the smart city concept presents an adequate way to fulfil such sustainability goals in Europe. Future research on the

topic depends on developing reliable indicators to assess smart city performance by thematic area. Furthermore, how responsive city concepts, such as citizen engagement, implicate governance should be explored more. Innovative city strategies aligned with the United Nations 2030 Agenda for Sustainable Development will ensure that European cities will progress technologically and progress technologically and remain long-term resilient and inclusive. Future studies should analyze the correlation between thematic areas and the sustainable development objectives for the strategic evolution of the innovative city framework to improve the efficiency and livability of the urban environment.

Recommendations

Government actions and public participation rate highly at 9.61% when developing smart cities. WienBot in Vienna helped handle 20% more public problems in 2022 through its digital governance system that engaged residents [20]. Scandinavian cities, especially Copenhagen, work with open data (80% municipal records available), but Lisbon, Southern Europe, struggles because of weak digital usage [31]. Every European city must build its governance system to match its residents' digital knowledge and network conditions by providing online and face-to-face access to services. Rulers must make public their data handling methods and defence measures to reduce privacy worries, as shown in Amsterdam controller systems where 30% of area residents showed discomfort [22]. Municipalities use these findings to build trust and accept participation from all city residents who want to contribute to better urban management.

The education and workforce development sector generates 9.58% of smart city operations by hammering new skills directly to help citizens seek jobs in a technology-dependent urban economy. The analysis showcases how Helsinki Education Cloud boosted student usage to 90 per cent and made students 15 per cent better at math by 2023. In Amsterdam Smart City Academy, the 2023 program placed 2,000 residents in technology jobs. These examples prove that digital platforms teach people better [19; 42]. Even though these systems need more funding, they restrict growth in smaller cities, and the Amsterdam approach favours skilled workers over unskilled workers. Public urban spaces need to connect vocational education to long-term funding sources to teach more people in the community. Planning authorities and educational institutions need to build digital literacy programs for everyone to make smart city features accessible to all groups of people and strengthen the social fabric of cities.

The research demonstrates the benefits of AI and IoT for city transport systems through Herrenberg SUMO and Copenhagen's Intelligent Traffic System. Computer models showed how 10% more bus trips improved traffic and decreased CO_2 emissions while the traffic management system reduced congestion by 15%. [37; 39]. The systems target transportation issues through better flow and eco-friendliness, although data issues affect potential application in Herrenberg, while costs affect implementation success in Copenhagen. Urban planners should use customized traffic methods like bike lanes for smaller towns but complete systems for bigger cities alongside solving legal barriers to self-driving vehicles. Planners support SDG 11 goals of better access while decreasing pollution using technology; however, they need to keep investments balanced to prevent digital disadvantages seen in WebCAT's London limits [40].

Energy efficiency is key to achieving sustainability through the Royal Seaport project's 30% energy reduction and 40% emission cut [35]. According to Lisbon's smaller example, the city's need for public support and funding makes these solar projects hard to reproduce in areas with fewer financial resources. Cities should begin updating their infrastructure at regular intervals and form alliances with private sector partners to deal with project budgets. Policymakers

should combine energy plans with SDG 13 activities and monitor systems online to reduce unnecessary use of resources. Following Stockholm's approach, urban planners should develop energy performance standards that fit local budgetary needs.

Study evidence from Tallinn shows how digital platforms and blockchain promote business growth through e-residency (100,000 resident's produce 5% yearly growth). Small cities must blend digital and face-to-face start-up services like Dublin to embrace e-governance. Cities must establish digital infrastructure for the market and government platforms as their economic engines but fix digital access gaps to create growth opportunities for everyone. The study's DEMATEL approach shows that economy and entrepreneurship stand apart as essential growth areas and suggests officials place start-up ecosystems into innovative city plans for better urban economy success.

Smart cities need clear measuring tools to evaluate performance since no accepted standards exist for comparing results across cities. Researchers demand valid measuring tools to track smart city approaches while observing how limited funding caused Santander's problems and how expensive systems limit London's success [31; 33]. Universal innovative city performance systems should be developed to help cities evaluate their progress and replicate successful solutions such as Santander's IoT platform and Vienna's community involvement. Technology companies should create repeatable solutions for cities with various needs by adapting systems used in SUMO Herrenberg and the Lisbon waste management system [37].

Alignment with Global Sustainability Goals: The study's alignment with the UN 2030 Agenda, particularly SDGs 11 and 13, positions innovative city technologies as a pathway to sustainable urban development. Cities in Santander and London use Industry 5.0 approaches to link humans and machines, which makes their smart city projects more resistant and open to everyone [44]. European cities should include SDG targets when using innovative city management systems while tracking performance data to guide their actions. Through these better-quality services, citizens' gain improved lives but must work with leaders to define technology needs. The research team recommends studying links between smart city topics and SDGs to maintain sustainable, innovative city development. Bollano's study shows how European cities should properly use innovative city technologies across governance, education, mobility, and sustainability sectors. Its findings demand stakeholders improve digital access while creating reliable assessment methods supporting international eco-friendly development plans. Through partnerships between public organizations and residents, cities can make better, more resilient neighbourhoods that benefit everyone as they develop innovative city initiatives.

REFERENCES

1. Ahvenniemi, H.; Huovila, A.; Pinto-Seppä, I.; Airaksinen, M. What are the differences between sustainable and smart cities? *Cities* 2017, *60*, 234–245. [CrossRef]
2. Al Nuaimi, E.; Al Neyadi, H.; Mohamed, N.; Al-Jaroodi, J. Applications of big data to smart cities. *J. Internet Serv. Appl.* 2015, *6*, 25. [CrossRef]
3. Alfakeeh, A.S.; Javed, M.A. Efficient Resource Allocation in Blockchain-Assisted Health Care Systems. *Appl. Sci.* 2023, *13*, 9625. [CrossRef]
4. Aline de Ávila, F. *Estratégias e Iniciativas para a Mobilidade em Cidades Inteligentes*; Trabalho de Conclusão de Curso, Engenharia Civil; Universidade Federal do Rio Grande do Sul UFRGS: Porto Alegre, Brazil, 2016. [Google Scholar]
5. Aloqaily, M.; Otoum, S.; Al Ridhawi, I.; Jararweh, Y. An intrusion detection system for connected vehicles in smart cities. *Ad Hoc Networks* 2019, *90*, 101842. [CrossRef]
6. Amiri, M.; Sadaghiyani, J.S.; Payani, N.; Shafieezadeh, M. Developing a DEMATEL method to prioritize distribution centers in the supply chain. *Manag. Sci. Lett.* 2011, *1*, 279–288. [CrossRef]
7. Aujla, G.S.; Singh, M.; Bose, A.; Kumar, N.; Han, G.; Buyya, R. BlockSDN: Blockchain-as-a-Service for Software Defined Networking in Smart City Applications. *IEEE Netw.* 2020, *34*, 83–91. [CrossRef]
8. Bajdor, P.; Starostka-Patyk, M. Smart City: A Bibliometric Analysis of Conceptual Dimensions and Areas. *Energies* 2021, *14*, 4288. [CrossRef]
9. Belli, L.; Cilfone, A.; Davoli, L.; Ferrari, G.; Adorni, P.; Di Nocera, F.; Dall'olio, A.; Pellegrini, C.; Mordacci, M.; Bertolotti, E. IoT-Enabled Smart Sustainable Cities: Challenges and Approaches. *Smart Cities* 2020, *3*, 1039–1071. [CrossRef]
10. Ben Letaifa, S. How to strategize smart cities: Revealing the SMART model. *J. Bus. Res.* 2015, *68*, 1414–1419. [CrossRef]
11. Bibri, S.E.; Alexandre, A.; Sharifi, A.; Krogstie, J. Environmentally sustainable smart cities and their converging AI, IoT, and big data technologies and solutions: An integrated approach to an extensive literature review. *Energy Inform.* 2023, *6*, 9. [CrossRef] [PubMed]
12. Bibri, S.E.; Krogstie, J. Smart sustainable cities of the future: An extensive interdisciplinary literature review. *Sustain. Cities Soc.* 2017, *31*, 183–212. [CrossRef]
13. Bresciani, S.; Ferraris, A.; Del Giudice, M. The management of organizational ambidexterity through alliances in a new context of analysis: Internet of Things (IoT) smart city projects. *Technol. Forecast. Soc. Change* 2018, *136*, 331–338. [CrossRef]
14. Bueti, C.; Menon, M. The Evolution of Smart Sustainable. In *IEEE Technology and Engineering Management Society Body of Knowledge*; John Wiley & Sons, Inc.: Hoboken, NJ, USA, 2023; pp. 205–218. [CrossRef]
15. Coccoli, M.; Guercio, A.; Maresca, P.; Stanganelli, L. Smarter universities: A vision for the fast changing digital era. *J. Vis. Lang. Comput.* 2014, *25*, 1003–1011. [CrossRef]

16. Cunha, M.A.; Przeybilovicz, E.; Macaya, J.F.M.; Burgos, F. *Smart Cities: Transformação Digital de Cidades*; Programa Gestão Pública e Cidadania: São Paulo, Brazil, 2016; Available online: https://ceapg.fgv.br/sites/ceapg.fgv.br/files/u60/smart_cities_bra_versao_final.pdf

17. Dana, L.-P.; Salamzadeh, A.; Hadizadeh, M.; Heydari, G.; Shamsoddin, S. Urban entrepreneurship and sustainable businesses in smart cities: Exploring the role of digital technologies. *Sustain. Technol. Entrep.* 2022, *1*, 100016. [CrossRef]

18. Dembski, F.; Wössner, U.; Letzgus, M.; Ruddat, M.; Yamu, C. Urban Digital Twins for Smart Cities and Citizens: The Case Study of Herrenberg, Germany. *Sustainability* 2020, *12*, 2307. [CrossRef]

19. Dresch, A.; Lacerda, D.P.; Júnior, J.A.V.A. *Design Science Research: Método de Pesquisa para Avanço da Ciência e Tecnologia*; Bookman Editora: Porto Alegre, Brazil, 2015. [Google Scholar]

20. Fatimah, Y.A.; Govindan, K.; Murniningsih, R.; Setiawan, A. Industry 4.0 based sustainable circular economy approach for smart waste management system to achieve sustainable development goals: A case study of Indonesia. *J. Clean. Prod.* 2020, *269*, 122263. [CrossRef]

21. Gabus, A.; Fontela, E. *World Problems, an Invitation to Further Thought within the Framework of DEMATEL*; Battelle Geneva Research Center: Geneva, Switzerland, 1972. [Google Scholar]

22. Gibson, D.V.; Kozmetsky, G.; Smilor, R.W. *the Technopolis Phenomenon: Smart Cities, Fast Systems, Global Networks*; Rowman & Littlefield: New York, NY, USA, 1992. [Google Scholar]

23. Gravina, R.; Alinia, P.; Ghasemzadeh, H.; Fortino, G. Multi-sensor fusion in body sensor networks: State-of-the-art and research challenges. *Inf. Fusion* 2017, *35*, 68–80. [CrossRef]

24. Hoang, A.T.; Pham, V.V.; Nguyen, X.P. Integrating renewable sources into energy system for smart city as a sagacious strategy towards clean and sustainable process. *J. Clean. Prod.* 2021, *305*, 127161. [CrossRef]

25. Hromada, M.; Rehak, D.; Skobiej, B.; Bajer, M. Converged Security and Information Management System as a Smart City Infrastructure Resilience Assessment Tool. *Smart Cities* 2023, *6*, 2221–2244] [CrossRef]

26. Javed, A.R.; Shahzad, F.; ur Rehman, S.U.; Zikria, Y.B.; Razzak, I.; Jalil, Z.; Xu, G. Future smart cities: Requirements, emerging technologies, applications, challenges, and future aspects. *Cities* 2022, *129*, 103794. [CrossRef]

27. João Rafael da Cruz, G. Smart City: Desenvolvimento Sustentável, Sociedade de Controle e Cidade Inteligente. Master's Thesis, Programa de Estudos Pós-Graduados em Comunicação e Semiótica, Pontifícia Universidade Católica de São Paulo PUC-SP, São Paulo, Brazil, 2015. [Google Scholar]

28. Koca, G.; Egilmez, O.; Akcakaya, O. Evaluation of the smart city: Applying the DEMATEL technique. *Telemat. Inform.* 2021, *62*, 101625. [CrossRef]

29. Kolhe, R.V.; William, P.; Yawalkar, P.M.; Paithankar, D.N.; Pabale, A.R. Smart city implementation based on internet of things integrated with optimization technology. *Meas. Sensors* 2023, *27*, 100789. [CrossRef]

30. Kumar, H.; Singh, M.K.; Gupta, M.; Madaan, J. Moving towards smart cities: Solutions that lead to the Smart City Transformation Framework. *Technol. Forecast. Soc. Change* 2020, *153*, 119281. [CrossRef]

31. Kumar, S.; Dixit, A.S.; Malekar, R.R.; Raut, H.D.; Shevada, L.K. Fifth generation antennas: A comprehensive review of design and performance enhancement techniques. *IEEE Access* 2020, *8*, 163568–163593. [CrossRef]

32. Laufs, J.; Borrion, H.; Bradford, B. Security and the smart city: A systematic review. *Sustain. Cities Soc.* 2020, *55*, 102023. [CrossRef]

33. Ma, D.; Zhu, Q. Innovation in emerging economies: Research on the digital economy driving high-quality green development. *J. Bus. Res.* 2022, *145*, 801–813. [CrossRef]

34. Marinakis, V.; Doukas, H.; Tsapelas, J.; Mouzakitis, S.; Sicilia, Á.; Madrazo, L.; Sgouridis, S. From big data to smart energy services: An application for intelligent energy management. *Futur. Gener. Comput. Syst.* 2020, *110*, 572–586. [CrossRef]

35. Metallidou, C.K.; Psannis, K.E.; Egyptiadou, E.A. Energy Efficiency in Smart Buildings: IoT Approaches. *IEEE Access* 2020, *8*, 63679–63699. [CrossRef]

36. Mohammad, N. A multi-tiered defense model for the security analysis of critical facilities in smart cities. *IEEE Access* 2019, *7*, 152585–152598. [CrossRef]

37. Mora, L.; Bolici, R.; Deakin, M. The First Two Decades of Smart-City Research: A Bibliometric Analysis. *J. Urban Technol.* 2017, *24*, 3–27. [CrossRef]

38. Nam, T.; Pardo, T.A. Conceptualizing smart cities with dimensions of technology, people, and institutions. In Proceedings of the 12th Annual International Digital Government Research Conference: Digital Government Innovation in Challenging Times, College Park, MD, USA, 12–15 June 2011. [Google Scholar]

39. Pahan, M.A.; Mendes, S.L.; Breda, D.G. *Construindo Cidades Inteligentes*; Editora Appris: Mercês, Brazil, 2016. [Google Scholar]

40. Qureshi, M.A.; Khaskheli, A.; Qureshi, J.A.; Raza, S.A.; Yousufi, S.Q. Factors affecting students' learning performance through collaborative learning and engagement. *Interact. Learn. Environ.* 2021, *31*, 2371–2391. [CrossRef]

41. Rahman, A.; Srikumar, V.; Smith, A.D. Predicting electricity consumption for commercial and residential buildings using deep recurrent neural networks. *Appl. Energy* 2018, *212*, 372–385. [CrossRef]

42. Ramírez-Márquez, C.; Posadas-Paredes, T.; Raya-Tapia, A.Y.; Ponce-Ortega, J.M. Natural Resource Optimization and Sustainability in Society 5.0: A Comprehensive Review. *Resources* 2024, *13*, 19. [CrossRef]

43. Rana, N.P.; Luthra, S.; Mangla, S.K.; Islam, R.; Roderick, S.; Dwivedi, Y.K. Barriers to the Development of Smart Cities in Indian Context. *Inf. Syst. Front.* 2019, *21*, 503–525. [CrossRef]

44. Raza, U.; Kulkarni, P.; Sooriyabandara, M. Low Power Wide Area Networks: An Overview. *IEEE Commun. Surv. Tutor.* 2017, *19*, 855–873. [CrossRef]

45. Sen, M.K.; Dutta, S.; Kabir, G.; Pujari, N.N.; Laskar, S.A. An integrated approach for modelling and quantifying housing infrastructure resilience against flood hazard. *J. Clean. Prod.* 2021, *288*, 125526. [CrossRef]

46. Sharifi, A.; Khavarian-Garmsir, A.R.; Allam, Z.; Asadzadeh, A. Progress and prospects in planning: A bibliometric review of literature in Urban Studies and Regional and Urban Planning, 1956–2022. *Prog. Plan.* 2023, *173*, 100740. [CrossRef]

47. Shimizu, T. *Decisão nas Organizações*, 3rd ed.; Editora Atlas: São Paulo, Brazil, 2010. [Google Scholar]

48. Si, S.-L.; You, X.-Y.; Liu, H.-C.; Zhang, P. DEMATEL technique: A systematic review of the state-of-the-art literature on methodologies and applications. *Math. Probl. Eng.* 2018, *2018*, 3696457. [CrossRef]

49. Simonofski, A.; Vallé, T.; Serral, E.; Wautelet, Y. Investigating context factors in citizen participation strategies: A comparative analysis of Swedish and Belgian smart cities. *Int. J. Inf. Manag.* 2021, *56*, 102011. [CrossRef]

50. Soyata, T.; Habibzadeh, H.; Ekenna, C.; Nussbaum, B.; Lozano, J. Smart city in crisis: Technology and policy concerns. *Sustain. Cities Soc.* 2019, *50*, 101566. [CrossRef]

51. Sun, M.; Zhang, J. Research on the application of block chain big data platform in the construction of new smart city for low carbon emission and green environment. *Comput. Commun.* 2020, *149*, 332–342. [CrossRef]

52. Szpilko, D.; De La Torre Gallegos, A.; Jimenez Naharro, F.; Rzepka, A.; Remiszewska, A. Waste Management in the Smart City: Current Practices and Future Directions. *Resources* 2023, *12*, 115. [CrossRef]

53. Teng, H.; Liu, Y.; Liu, A.; Xiong, N.N.; Cai, Z.; Wang, T.; Liu, X. A novel code data dissemination scheme for Internet of Things through mobile vehicle of smart cities. *Futur. Gener. Comput. Syst.* 2019, *94*, 351–367. [CrossRef]

54. United Nations. Department of Economic and Social Affairs, Population Division. World Urbanization Prospects: The 2018 Revision, Online Edition. 2018. Available online: https://population.un.org/wup/Publications/Files/WUP2018-PopFacts_2018-1.pdf (accessed on 22 April 2023).

55. Van Eck, N.J.; Waltman, L. How to normalize co-occurrence data? An analysis of some well-known similarity measures. *J. Am. Soc. Inf. Sci. Technol.* 2009, *60*, 1635–1651. [CrossRef]

56. Wang, W.; Xia, F.; Nie, H.; Chen, Z.; Gong, Z.; Kong, X.; Wei, W. Vehicle Trajectory Clustering Based on Dynamic Representation Learning of Internet of Vehicles. *IEEE Trans. Intell. Transp. Syst.* 2020, *22*, 3567–3576. [CrossRef]

57. Westraadt, L.; Calitz, A. A modelling framework for integrated smart city planning and management. *Sustain. Cities Soc.* 2020, *63*, 102444. [CrossRef]

58. Zanella, A.; Bui, N.; Castellani, A.; Vangelista, L.; Zorzi, M. Internet of Things for Smart Cities. *IEEE Internet Things J.* 2014, *1*, 22–32. [CrossRef]

59. Zaręba, A.; Krzemińska, A.; Kozik, R. Urban Vertical Farming as an Example of Nature-Based Solutions Supporting a Healthy Society Living in the Urban Environment. *Resources* 2021, *10*, 109. [CrossRef]

60. Zhao, L.; Wang, J.; Liu, J.; Kato, N. Optimal Edge Resource Allocation in IoT-Based Smart Cities. *IEEE Netw.* 2019, *33*, 30–35. [CrossRef]

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