

Evolving Towards a Smart City: The Case Of Israel

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Abstract

This research examines Tel Aviv's transformation into a smart city to better understand the processes, governance and technology that facilitate change and what other cities can learn from it. The study was conducted to understand how growing digital inequalities might be addressed and to consider if the Tel Aviv model—rooted in citizen engagement and based on Digi-Tel—can serve as an example that is inclusive, and replicable. The study offers both theoretical and practical contributions, especially through the application of socio-technical systems and innovation diffusion theories. Based on a qualitative case study, interviews with 40 key stakeholders, were conducted. The study found that Tel Aviv's strategy is based on a bottom-up, citizen-centered approach anchored in the principles of digital inclusion, focusing on practical, daily, everyday services of every-day people in Tel Aviv, paired with multi-sector partnerships, engagement, and collaborations. Further, the most promising way to successfully integrate smart cities and the philosophy of inclusion and equity is to place the citizen first. The study concludes with recommendations that prioritize public engagement, citizen-centered design, integrated governance models, ethical data considerations, and support for smaller to mid-sized municipalities, which connect to many themes and issues raised throughout this study. The significance of this research is the need for cities to develop and continue strategies that are inclusive for all participants in smart cities; subsequent processes based on democratic engagement, transparency, and sustainability in connection to urban innovations and smart cities.

Keywords: smart city, Digi-Tel platform, citizen-centered approach, smart governance, citizen engagement, innovation ecosystems, and socio-technical systems.

1. Introduction

This research examines the evolution of Tel Aviv into a significant smart city that operates within a larger national digital strategy by exploring and examining its governing techniques, citizen-focused initiatives, such as the Digi-Tel platform, and civic engagement. The research defines smart cities as digitally based urban ecosystems aimed at strengthening governance, mobility, and public participation. Critical issues involve smart governance, citizen engagement, innovation ecosystems, and socio-technical systems (Nam & Pardo, 2011; Gil-García et al., 2015). The research addresses a gap in the literature that removes the sociable aspects of the more extensive discussions on the digitization of urbanity, especially in non-Western contexts and that demonstrates alternative civic engagement models to more prominent 'top-down' smart city projects in the region (e.g., Singapore; Barcelona). Through qualitative case study analysis, the research stems from interviews, document assessments, and an examination of policy, and a guided list of seven essential questions to define what kind of smart city strategy, citizen engagement, and innovation infrastructure and ecosystems are effective, as well as demonstrate the challenges, and gain insights from other municipalities. The central themes of the findings demonstrate that Tel Aviv was successful primarily due to effective grassroots and/or local leadership, the ability for citizens, organizations, and agencies to harness free and inclusive digital tools in the process of co-developing the city, as well as the inclusion of actively engaged citizens, and that there remain

digital inequalities by size and resources between municipalities in and outside of the City of Tel Aviv. The research calls for scalable, inclusive frameworks for smart cities, coordinated processes of national government support, and better harmonization of municipal planning policies and resources, in order to eradicate urban digital divides, as well as provide practical implications for urban and municipal planning and theoretical contributions related to the models of diffusion of innovations and socio-technical integration.

2. Literature Review

The notion of the smart city has developed as a central concept for urban development in the 21st century, spurred by rapid urbanization and advances in digital technology (Nam & Pardo, 2011; Caragliu et al., 2011; Albino et al., 2015). However, the term “smart city” is interpreted in different ways, and scholars have not settled on a singular definition (Cocchia, 2014). Indeed, there are various definitions and related terminology (i.e., digital city, intelligent city) present in the literature, but there is not yet a universally accepted, definitive statement on what a smart city is (Cocchia, 2014). Despite this confusion, most definitions imply that it is leveraging information and communication technologies (ICT) to improve the efficiency and sustainability of urban service delivery and improve quality of life (Caragliu et al., 2011; Albino et al., 2015). In the past 10 years, smart cities have gained an overwhelming degree of interest, as reported by the significant increase in the number of publications and city led initiatives around the world (Mora et al., 2017; Stübinger & Schneider, 2020). This significant growth has created a wide, and yet fragmented, body of literature that covers such a vast array of disciplines and fields of study, that can ultimately lack logic and cohesion (Bibri & Krogstie, 2017; Zhao et al., 2021). As such, a comprehensive literature review is warranted, one that will synthesize the existing knowledge around smart cities, and look for common themes, trends, and gaps in the evolving literature (Stübinger & Schneider, 2020; Zhao et al., 2021).

2.1 Definition and Evolution of the Smart City Concept

Typically, the term "smart city" represents a fresh perspective on urban areas that aims to enhance urban services, develop sustainable cities, and improve people's quality of life through new methods of information and communication technologies (ICTs) and data-driven solutions (Caragliu et al., 2011; Albino et al., 2015). The original definitions of smart city tended to focus on how ICT infrastructure could be beneficial for improved performance of city systems. For example, one could assess physical infrastructure through digital networks for resource and service productivity (Harrison et al., 2010; Nam & Pardo, 2011). The terminology has evolved to not only include technology, but other factors related to people and society, economic development, and governance (Nam & Pardo, 2011; Meijer & Bolívar, 2016). Caragliu and others (2011) described a "smart" city as one where investments in human and social capital and traditional and modern (transportation and ICT) infrastructure lead to sustainable economic growth and a high quality of life, with participatory governance. This broad view illustrates that smart cities involve more than technological implementations, as they also involve integrating technologies with people and organizations in order to improve cities (Gil-Garcia et al., 2015; Bibri & Krogstie, 2017).



Figure 1: Smart City Model Source: (Gade, 2019).

The concept of the smart city has been developed over a series of phases that overlap with one another. In Smart City 1.0 (circa late 2000s to early 2010s), the focus was on technology-driven solutions, dominated by the likes of IBM, and the associated infrastructure and efficiency of the idea, while often sidelining social and local contexts. In Smart City 2.0, local governments are now primary actors that prioritize citizen engagement through open data and increased opportunities for collaborative governance. Smart City 3.0 has sought to focus on sustainability, inclusion, and integrated forms of problem solving across social, environmental, and economic challenges. Despite coming to the fore in different order throughout these phases, the main idea throughout has been that smart cities should strive to balance technological innovation with striving for human and policy-oriented outcomes, while also addressing sustainable development goals.

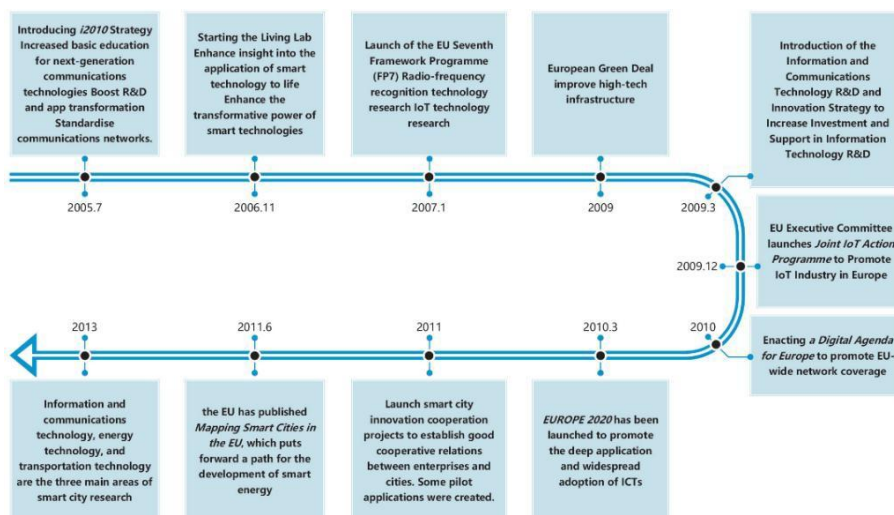


Figure 2: Schematic diagram of the EU smart city development process Source: (WU, 2025).

2.2 Key Dimensions and Pillars of a Smart City

Researchers generally agree that a smart city has several important "pillars" or aspects that together define how well it works, even though definitions differ. Smart Economy, Smart People, Smart Governance, Smart Mobility, Smart Environment, and Smart Living are six

primary smart city dimensions that are commonly employed (Caragliu et al., 2011; Neirotti et al., 2014). This six-dimensional model, which comes from previous European smart city research and is still widely used, shows how complex urban "smartness" may be (Caragliu et al., 2011; Manville et al., 2014).

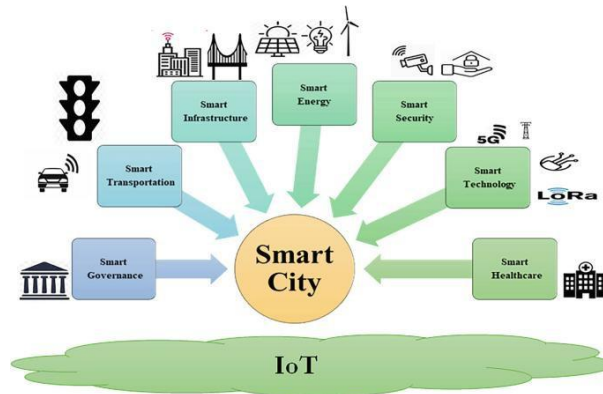


Figure 3: The General six dimensions model of smart city Source: (Mishra & Singh, 2023).

2.3 Global Smart City Initiatives

Over the last ten years, smart city approaches have gained traction across the globe, with cities such as Barcelona, Singapore, and Amsterdam emerging as leadership examples of innovation and best practice (Neirotti et al., 2014; Veloso et al., 2024; Angelidou, 2017). Barcelona is remarkable for being one of the earliest adopters and embracing ICT in a holistic way such as e- governance, smart mobility and urban living labs such as its 22@ district, and having established strong public-private partnerships and municipal ownership (Bakici et al., 2013; Angelidou, 2017). As a smart city leader example, Singapore's "Smart Nation" program is a centrally controlled top-down program that the goal is to utilize nationwide existing ICT infrastructure, real-time transport system, digital governance; to help society overcome challenges such as ageing, urban density and traffic congestion (Lee et al., 2016; Veloso et al., 2024). On the other hand, Amsterdam for example, with its decentralized, citizen-led model, encouraged grassroots innovation by establishing public-private partnerships and city partnerships, living labs, open data, and sustainability projects that aimed to reduce CO₂ emissions (Brokaw, 2016; Angelidou, 2017;). These different governance approaches (top-down and bottom-up) demonstrate how governance can affect the outcomes of smart cities and demonstrate transferable lessons learned on digital transformation, citizen participation, and inclusive urban development (Neirotti et al., 2014; Veloso et al., 2024).

2.4 Smart City Development in Israel: The National Context

Israel's smart city development is deeply shaped by its high urbanization levels and strong national digital policies, notably the "Digital Israel" initiative led by the Ministry of Social Equality, which supports municipalities—particularly under- resourced ones—in advancing digital transformation (Hatuka & Zur, 2020; Shefer, 2021). While municipalities retain autonomy, the national government plays a facilitative role through funding, regulatory frameworks, and strategic innovation programs, such as those by the Israel Innovation Authority, which prioritize areas like mobility, energy, and sustainability (Yigitcanlar & Kamruzzaman, 2019; Beck & Vigoda-Gadot, 2023). A wide ecosystem of stakeholders—including local governments, national ministries, tech startups, and academia—collaborate to

promote smart city experimentation and implementation (Hatuka & Zur, 2020; Herscovici et al., 2022). Larger cities like Tel Aviv operate dedicated smart city teams, while smaller municipalities rely on national guidelines and consultants (Shefer, 2021). Israel's vibrant startup sector, known for urban technologies ranging from mobility apps to smart infrastructure, plays a catalytic role, supported by public-private partnerships and innovation labs such as Tel Aviv's CityZone (Hatuka & Zur, 2020; Beck & Vigoda-Gadot, 2023). However, researchers caution that while tech companies accelerate innovation, municipalities must govern these partnerships carefully to ensure that technological solutions meet local social needs and do not overly commercialize urban agendas (Hatuka & Zur, 2020; Nathansohn & Lahat, 2022). Thus, Israel's smart city model reflects a multi-level, innovation-driven governance approach that balances technological advancement with social inclusion.

2.5 Tel Aviv – The Leading Smart City

As an example, at a national and international scale, Tel Aviv-Yafo is recognized as Israel's most successful smart city (Hatuka & Zur, 2020; Herscovici et al., 2022). Tel Aviv launched its signature "Digi-Tel" program in 2013, whereby citizens were digitally connected to municipal services, and Tel Aviv, the economic and high-tech heart of Israel, was ahead of the curve in entering a global conversation about smart cities (Hatuka & Zur, 2020). Helpfully, Digi-Tel promotes citizens to engage with the city's digital ecosystem, through Digi-Tel, a personalized citizen platform that provides residents with tailored information, online services (such as e-payments and permit applications), and specialized perks such as discounts for city events (Herscovici et al., 2022). Furthermore, the city has invested in urban ICT (information and communications technology) to improve connectivity and efficiency in public areas, such as free Wi-Fi, sensor streetlights, and intelligent traffic programs, to name a few (Herscovici et al., 2022). Driven by a strategic vision to leverage technology to improve livability and sustainability of its cities, Tel Aviv's municipal leadership intentionally connected its smart city strategy to a vision to enable environmental sustainability, improved transportation to work and recreation, and engage citizens in the municipal agenda (Shefer, 2021; Herscovici et al., 2022). A single strategy can encompass many and varied "smart" domains, as the case of Tel Aviv demonstrates with its embedding of e-government, urban mobility, public safety (to name a few) (Herscovici et al., 2022). Additionally, Tel Aviv is notable for its people-centric model. While the goal is to develop an urban environment to meet resident needs through digital tools and platforms, technology does not drive the agenda for the sake of technology. This is consistent with international practices of good smart urbanism (Herscovici et al., 2022; Nathansohn & Lahat, 2022).

Tel Aviv's position as a leader in smart cities has yielded measurable results and been recognized widely. As a culminating international recognition of its strides in digital innovation and citizen engagement, Tel Aviv received the Smart City Award in 2014 at the Smart City Expo World Congress held in Barcelona (Hatuka & Zur, 2020). Awarded to Tel Aviv only a year after Digi-Tel went live, this award provided confirmation that Tel Aviv was able to embrace smart city principles in a relatively quick time frame to improve urban service and the experience of residents in a

measurable way (Hatuka & Zur, 2020). An emerging body of academic and policy literature in recent years has described Tel Aviv's bottom-up and inventive nature of innovation, along with municipal support of innovation and development, as an example of successful development as a smart city (Shefer, 2021; Herscovici et al., 2022). Tel Aviv's organizational structure has been singled out for its governance model applying to smart cities: and rather than establishing a dedicated "smart city department," Tel Aviv integrated smart initiatives into existing departments, such as community services, engineering, and education, under the governance of the mayor's office and active coordination from the municipality's information technology unit (Herscovici et al., 2022). Integrated governance prevents fragmented and partial implementations by recognizing that technology projects should not be separate from social policy and urban planning. Tel Aviv continues to develop its offerings, with examples being its recent civic hackathons, open data portal, and autonomous public transit trials, providing evidence of its commitment to innovating on the smart city frontier (Shefer, 2021). The city has also implemented a local tech scene and has engaged citizens for the provision of digital services, establishing Tel Aviv-Yafo as a "living lab" for urban innovation in Israel. Lastly, Tel Aviv has provided lessons for other cities in Israel and abroad that aim to replicate success (Hatuka & Zur, 2020; Herscovici et al., 2022).

3. Material and methods

In this case study a multi-method data collection strategy was put to use to study the smart city evolution of Tel Aviv. A triangulation of documentation review, semi- structured interviews and observational data was used to demonstrate methodological rigor and validation. A multi-method approach is a necessary method of data collection when studying a smart city, as it allows data verification across independent data sources (Anthopoulos, 2017). Triangulation is also useful in the Tel Aviv context to resolve the gap between a city's official narrative, stakeholder experience and real-life situation. A multi-method approach combined multiple sources of data, to reduce bias in individual sources of data and build a substantial body of supporting evidence (Anthopoulos, 2017; Hatuka & Zur, 2020). While the methodological approach in of itself met the criteria for best practices of case study research design, it also ensured the validation of findings through cross-validation and thick contextualization. Overall, the design of this case study demonstrates a multifaceted look at Tel Aviv's smart city journey to support validity assets and validity claims of the findings (Anthopoulos, 2017; Hatuka & Zur, 2020).

Semi-structured interview questions were also used to collect interview responses from 40 individuals. The sample includes a diverse range of stakeholders such as municipal officials, city planners, government officials, startup technology experts, academic researchers, and urban innovation experts. A notable portion of the sample consists of Tel Aviv residents who were actively engaged in citizen-centric initiatives, along with policy advisors, construction engineers, urban infrastructure engineers, ICT and systems engineers, and digital consultants. This professional diversity ensures a comprehensive understanding of the multidisciplinary nature of smart city projects in Tel Aviv.

4. Results

By highlighting persistent patterns across the data collected via different methods, and organizing these into a number of major themes, each theme encompasses a separate yet interrelated aspect of the city's smart governance framework.

Theme 1: Citizen-Centric Digital Innovation

One of the main themes that emerged from the data analysis showed that the effectiveness of Tel Aviv's smart city model came from their specific digital innovation model, resident-centric around digitalized change. First, they used real needs of residents rather than fancy high-tech stuff. The Digi-Tel was researched and designed using communities, which enabled to remind local residents of events, service reminders, and share community information with real local developments. As a local municipal employee stated, *"We made a conscious decision to focus on the residents rather than the technology itself... initiatives like the Digi-Tel platform were developed not just by consultants, but in conversation with our communities."* Residents describe using Digi-Tel as an app imploring: *"I remember signing up for the Digi-Tel platform and thinking, 'This actually understands my needs.'" Such features tailored developed around this process, Digi-Taf for parents or Digi-Dog for pet owners, deepen their engagement with the platform and institutional trust. As summed up by one digital consultant, "a bridge between the municipality and the community."* And a resident noted, *"Now, I find myself actively using the app... it's made me feel more like a citizen, not just a resident."* What illustrates here is the impact of embedding a technology nicely into personal lived experience like this has on dimensions of civic engagement and citizens inclusive.

Theme 2: Strategic Use of Technology for Public Good

Tel Aviv's smart city vision was more of a thoughtful, public good focused, values-based approach to technology in contrast to other larger urban areas that appear to develop technological spectacles. Rather than developing flashy mega-projects, Tel Aviv focused on meaningful and real tools: public wi-fi, smart lighting and sensor traffic systems, all in the spirit of addressing real urban challenges such as safety and digital exclusion. An urban planner remarked, *"We didn't use technology for prestige - we used it for people"* in reference to its work establishing free wi-fi in disadvantaged neighbourhoods. An urban innovation expert also recalled that Tel Aviv's smart lighting was predicated in unsafe areas of the City and in the spirit of engaged planning TRI explicitly sought resident feedback and discussions and stated, *"This is what a smart city should be: not just wired, but wise"*. CityZone also established an innovation ecosystem to engage locally with city startups and universities and not rely nationally on overseas consultants. A tech developer stated, *"The city trusted the local talent"* describing, how they developed scalable solutions with real-time collaboration and open data. Similarly, an academic researcher praised the participatory approach, saying, *"Tel Aviv didn't outsource its smart city vision—it developed it internally."*

Theme 3: Strong Citizen Engagement and Participatory Governance

The smart city model of Tel Aviv is remarkable and largely attributed to strong levels of citizen engagement and participatory governance that positions members of the community as partners in the development of urban life. Each level of participatory engagement includes norms that utilize applications like Digi-Tel that allow citizens to both receive and report to the municipality when making comments, issuing service requests, and assisting in decision-making. In the words of one citizen, *"With Digi-Tel."*

. . I have a part in city—not just I live in city. . . I have seen few times I report we then see things get fix" A policy adviser confirmed this change, *"We built [Digi-Tel] to have a real dialogue about city planning... When things get raised a couple times, we bump it to our agenda."* The concept of participatory governance provided Tel Aviv with world-wide recognition where Tel Aviv received the 2014 Urban Innovative award at that year's Smart City Expo.

Theme 4: Integrated and Innovative Governance Structure

Tel Aviv's success as a smart city is deeply tied to its integrated and innovative governance structure, which embedded digital transformation into the core of municipal operations rather than treating it as a separate initiative. Unlike cities that establish isolated smart city departments, Tel Aviv empowered its existing municipal system, led by the Computing and Information Systems Department, to collaborate across sectors such as education, engineering, and community services under the leadership of the municipal CEO. As one official noted, *"We didn't treat it as a side project—we integrated it directly into the city's core governance,"* enabling smoother implementation and alignment with resident needs. This cross-departmental model broke bureaucratic silos and made smart solutions standard practice. A construction engineer explained, *"Now... we're constantly collaborating,"* pointing to how road projects are planned in tandem with smart tech features. High-level appointments such as a Chief Knowledge Officer and a smart city steering committee further institutionalized digital leadership, fostering shared strategy and innovation. An ICT engineer emphasized, *"IT was no longer a support role—it was part of the strategy,"* highlighting the shift toward inclusive, agile, and collaborative governance. This model reflects the people-process-technology integration proposed by Gil-García, Pardo, and Nam (2015), positioning Tel Aviv as a replicable example of sustainable and participatory smart city governance.

Theme 5: Challenges of Digital Inequality and Ethical Concerns

While Tel Aviv has succeeded in many areas of the smart city agenda, it faces significant and potentially important challenges pertaining to digital inequality and ethical issues relating to accessibility and data privacy. Many individuals face a gap in accessing this service due to one of various obstacles—such as income, digital age, or lack of digital literacy. *"A lot of people don't have reliable internet, or they don't have digital literacy... It's a gap,"* said one city planner, while a 66-year-old resident noted, *"I feel like these digital tools were made for younger people... I feel invisible in this new system."* This gap indicates how innovation, if it is not inclusive, can perpetuate social inequalities. The interviews also revealed issues of data privacy. As engagement increases so too does data collection, as one ICT engineer pointed out, *"regulation has not yet been able to fully catch up... we need a city-wide data governance framework."* A policy specialist agreed, emphasizing how there is *"not a fully articulated policy"* for how to use and protect data. Both observations support the notion that in order to be a smart city it takes more than technology; it is also being about equitable access, digital literacy interventions, and ethical data practices to ensure trust, inclusion and civic legitimacy.

5. Discussion

This study examined Tel Aviv's trajectory as a model smart city via qualitative case study, considering how its bottom-up, citizen-based approach was distinct from centralized models like Singapore, and why it complemented collaborative innovation models used by cities like Barcelona and Amsterdam (Angelidou, 2017; Kummitha & Crutzen, 2017; Herscovici et al., 2022). Drawing from socio-technical systems theory (Nam & Pardo, 2011) and conceptualizations of innovation diffusion (Komninos, 2011; van Winden & van den Buuse, 2017), the research looked at seven research questions on strategy, citizen engagement, infrastructure, innovation, the global context, challenges, and learning points. Tel Aviv's strengths are based on its flexible governance, collaboration with non-profit and for-profit groups, and platforms such as Digi-Tel, which personalize service delivery and facilitate citizen engagement (Weinstein, 2017; Lahat & Nathansohn, 2022). The ecosystem for innovation integrates local start-ups, universities, and civil society as co-creators of living labs that studied scalable digital solutions. The city's decentralized model and multilingual access to services are citizen-inclusive (Hatuka & Zur, 2020; UN-Habitat, 2022). The city continues to grapple with its digital divide, its maintaining infrastructure, and privacy concerns particularly in an environment of fragmented national policies (State Comptroller, 2020; Shefer, 2021). In summary, Tel Aviv provides experiences on how local leadership and adaptive governance can facilitate real smart city advancement, especially important in national contexts lacking comprehensive strategic direction— while highlighting continued systemic inequities and local support needed to prevent digital divide deepening (Ministry for Social Equality, 2017; van Deursen & Helsper, 2015).

6. Conclusion

The overall conclusion of the study was that Tel Aviv's success as a smart city came from embracing a citizen-centered, bottom-up, approach to technologies and focusing on easily accessible and practical digital services like the Digi-Tel platform, as opposed to investing in larger infrastructure projects, which developed trust, led to civic participation, and created opportunities for social innovation. Tel Aviv's methods of partnering with startups, universities and civil society actors, nurtured a diverse ecosystem for experimentation while being aligned with socio-technical systems, diffusion of innovation and smart city governance theory. The study did note challenges such as digital inequality as it affected specific groups, such as the elderly and low-income residents, and the lack of a national framework to provide support to smaller municipalities. The research suggests, an ideal way forward is to design inclusive digital services with multilingual access, literacy programs, and a hybrid model, all while addressing ethical data governance along with an emphasis on democratic participation across urban management. Future research should include examining the adaptability of Tel Aviv's model to cities with limited resources, study the long-term engagement and trust effects of developing digital platforms such as Digi-Tel, and explore public-private innovation ecosystems together with ethical considerations in data governance, especially as it relates to transparency and independent, informed consent in a diversified urban environment.

7. References

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