

From Masdar City, Abu Dhabi to Florya, Istanbul: What Can We Learn from Smart Cities?

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Abstract

Masdar City is one of the first smart city models that emerged as an ambitious project, aiming to become the world's first zero-carbon, zero-waste city, weaving technology into its urban fabric. Today, the project remains unfinished and is largely a ghost town, neglecting the most crucial component of a city: people. Learning from Masdar City, how can we design more people-centric smart cities? This paper proposes a future city model for a site in Florya, Istanbul. We explore how urban planning can benefit from "smart" initiatives that promote social connection through volunteering, supporting local production, and prioritising pedestrian-friendly mobility. Future cities do not have to be technological utopias but offer a reasonable interpretation of community needs to build a just and equitable future.

Keywords: Masdar City; Florya, Istanbul; Urbanisation; Future Cities; Community Development

1. Introduction

In light of the world's rapid technological development and increased environmental consciousness, future cities, often called smart cities or eco-cities, emerge as an initiative to leverage technology for sustainable development. Sustainable development, composed of the social, economic, and environmental pillars (United Nations, 2002), has become a pressing global concern, and balancing these pillars is a significant challenge in our capitalist-driven world. This dilemma has been particularly evident in future cities as the vision drifts away from a people-centric approach to a revenue-driven, profit-oriented urban model.

Masdar City is no stranger to the aforementioned urban challenge. Located in Abu Dhabi, United Arab Emirates (UAE), Masdar City came to life as the world's first city with a zero-carbon, zero-waste goal. Considering the UAE's oil-based economy and future resource scarcity, it became essential for the UAE to explore potential urban solutions and alternative economic models. Launched in 2006 as a subsidiary of the Mubadala Investment Company, the 640-hectare city is a testing ground for innovative renewable energy solutions and diverse sustainability-oriented technologies within the UAE's challenging context (Foster + Partners, n.d.), particularly its harsh climate and the Emirati society's lavish lifestyle (Fattah, 2007). Thus, one of Masdar City's main goals is to show that achieving a high quality of life with minimal environmental impact is possible (D'Eramo, 2021).

Masdar supports Abu Dhabi's transition to a knowledge-based economy as part of the Abu Dhabi Economic Vision 2030 (Masdar, 2020), and its goal as a zero-carbon, zero-waste city further creates a positive incentive towards technological and economic development. Foster and Partners, the design firm that dealt with Masdar City's master plan, introduced design solutions and strategies that aim to reduce energy consumption while fostering Masdar's desire for technological innovation, including narrow shaded streets inspired by traditional Emirati architecture (Ibrahim, 2016), "wind and photovoltaic farms, research fields, plantations" (Foster + Partners, n.d.), and an electric personal rapid transport system (Cugurullo, 2013). The city also attracted major companies, including Siemens and General Electric, reflecting its power as a business hub. These companies play an integral role in Masdar's economic model as their innovations are promoted and displayed in Masdar City as a living portfolio (Cugurullo, 2013; Cugurullo, 2016).

While the master plan of Masdar City is still not fully implemented, the analysis in this paper discusses how the city has a business-oriented model focusing on the economic pillar of sustainability, rendering the social component of the city neglected. Furthermore, it highlights how the integrated technologies resulted in more shortcomings than advantages. Thus, this study envisions what prioritising social sustainability while benefiting from technology could look like. To explore this concept, this paper proposes an experimental approach entitled “The Social City” in Florya, Istanbul. “The Social City” aspires to integrate urban planning and design decisions along with technology to create a lively city that fosters community bonds and encourages people to socialise and interact with each other.

2. To What Extent Is Masdar City What It Claims to Be?

The current reality of Masdar City has not aligned with its initial vision. After the 2008 financial crisis, the UAE's economy was highly affected, and ever since, the plans and reality of Masdar City have changed significantly (Griffiths and Sovacool, 2019). The original goal was to become a zero-carbon, zero-waste city with 40,000 residents by 2016 (Premalatha et al., 2013). Masdar City's reports indicate that the current sustainability efforts have been modified to decarbonisation initiatives, and the original net-zero goal is to be reached by 2050 (ESG 2023, 2023). However, the multiple delays and changes in defining the goal (Figure 1) and the budget cut from 22 billion dollars to 18 billion dollars may reflect some scepticism about the vision's attainability and feasibility.



Figure 1: The Construction Progress of Masdar City since 2009

While integrating technology into future cities can be beneficial, multiple technologies adopted in Masdar City failed in terms of efficiency, application, and utilisation. For example, the photovoltaic plants, which were expected to generate approximately 17,500 megawatt-hours of clean energy (masdar.ae, n.d.), face the issue of excessive dust accumulation, which significantly decreases their efficiency, and cleaning them is a resource-intensive solution (Omar, 2018). Another example is the idea of the Ergos energy-based currency that replaces traditional money with kilowatt-hours to monitor household consumption (Günel, 2014). Each citizen is given an energy budget, helping Masdar reach its energy and zero-carbon goals. However, while the solution appeared to be a promising tech-based innovation, the idea was disregarded due to the cost and financial considerations of installing the necessary monitoring systems, the solution's heavy reliance on educating the human actors in the system, and the fear of data exploitation (Günel, 2014; D'Eramo, 2021). Such examples reflect how some of the tech and innovation-based solutions adopted in the city were rendered inefficient due to the cost needed to maintain them or their requirement of a significant paradigm shift in citizen lifestyles and governance. This highlights the paradox that excessive dependence on technology in a smart city may, in practice, be “unsmart.”

Another primary concern is Masdar City's reliance on the UAE's conventional oil-based economy for sustenance since the renewable energy solutions adopted were insufficient to power the city (Cugurullo, 2016). As Masdar City was supposed to be the world's first zero-carbon city, such an approach defeats the entire *raison d'être* of Masdar City. Furthermore, its reliance on oil raises an important question: If the existing infrastructure is inadequate to sustain a partially built city, how can we be sure that Masdar City will truly achieve its net-zero goals

once fully developed? While this reality may change once the master plan is complete, it still highlights the drawbacks of an overly ambitious vision, often fuelled by the smart city concept.

While Masdar City claims to aim for a well-rounded sustainable approach, the city, which operates as a living portfolio for companies that produce green technologies, is, in reality, a research and development-based business model that aims to attract developers, investors, and potential buyers (Cugurullo, 2013; Cugurullo, 2016). These companies play an integral role in Masdar's economic model as their innovations are promoted and displayed in Masdar City as a marketing and business strategy for both parties. While this is not necessarily a negative approach, it prioritises economic sustainability over the other pillars. Furthermore, environmental sustainability in Masdar City is primarily attained by supporting green technology companies and working towards sustainability certifications. While a good start, it still reflects a limited interpretation of the pillar and its complexity. Social sustainability, however, remains largely neglected. A city's main living component is its people; however, Masdar City is deemed a "ghost town" (Goldenberg, 2016). Even though the project was designed for around 50,000 people, the almost-empty city's main users are those associated with Masdar City's research university or company employees. The reasons go back to multiple factors, mainly the high living costs. Masdar City's design focused more on titles, numbers, catchy marketing ideas, and futuristic innovations rather than the actual needs of the users. Furthermore, considering its approach as a business city, it innately appeals to social elites rather than people of diverse backgrounds and social classes (Cugurullo, 2016).

Upon examining the initial vision of Masdar City, it was primarily meant to be an investment company that aims to create a new model of economy motivated by climate change and resource scarcity in the form of a techno-city (masdar.ae, 2019; Cugurullo, 2016). This goal boasts a commercial incentive instead of truly targeting sustainability and all its pillars. Thus, sustainability is approached more as a business strategy than a holistic urban practice, and social sustainability remains fundamentally unaddressed.

3. Background

As smart cities like Masdar City emerge, analysing their implications is necessary for a more conscious, well-informed approach to urban planning. Some leading voices in the study of smart cities include Carlo Ratti, Anthony Townsend, Adam Greenfield, and Ben Green, who present their varying ideas, thoughts, and concerns about integrating smart solutions into our urban fabric.

Ratti affirms the potential of technology in creating more efficient and adaptive urban systems through the power of data and citizen interaction (Ratti and Claudel, 2016). In his book "The City of Tomorrow: Sensors, Networks, Hackers, and the Future of Urban Life" with Matthew Claudel, he discusses how more mobile phones with active service exist than people, showing the potential of sharing services in a way that has never been done before. With this potential unlocked, Ratti envisions the transformation of urban dynamics with the Internet of Things to improve quality of life and make our lives more efficient and practical. For example, he discusses a scenario where self-driving cars and other modes of transportation could be shared and moved where needed based on a model that predicts demand (Ratti and Claudel, 2016). His views are relatively optimistic about the potential of technological integration in our cities; however, his thoughts are more exploratory, lacking solid grounds for how people would interact and come together considering this new movement. In addition, the potential he discusses is only relevant in the developed world or places where sufficient funding is available for this technological leap (Evans-Cowley, 2016).

On the other hand, Townsend highlights how our transition to smart cities is inevitable; however, he finds that our response to technology is a critical challenge (Townsend, 2013). In his book "Smart Cities Big Data, Civic Hackers, and the Quest for a New Utopia", Townsend (2013) discusses how "smart cities need to be efficient but also preserve opportunities for spontaneity, serendipity, and sociability." He believes that our current cities are the "smartest cities" and that envisioning utopian smart cities does not necessarily mean addressing the problems we currently face. He also acknowledges that each city and society is unique, meaning no tech-based solutions will be the same everywhere (Townsend, 2013). Thus, involving citizens in the planning and implementation pro-

cess of smart cities is crucial to ensure that technology serves the public.

Greenfield, in his book "Against the Smart City", criticises the conception of a top-down smart city approach that reduces people, their complexities, and interactions with the built environments to mere algorithms, warning against the dangers of treating technological systems as a universal solution (Greenfield, 2013). Greenfield (2013) also depicts how efficiency cannot be the only "metric by which urban processes ought to be judged," emphasising how this approach resembles the views of modernist planning approaches, which ultimately failed. His views also shed light on people as the smart component of the city, reflecting how urban technology should aim to support human activity instead of overpowering them and treating humans as mere sources of data. This is crucial since he regards technology as non-neutral, with each technology "encoding a hypothesis about human behaviour" (Greenfield, 2013).

Finally, Green, the author of "The Smart Enough City: Putting Technology in Its Place to Reclaim Our Urban Future," advocates for the concept of the smart enough city, reflecting how too much technology can have significant drawbacks on the city and public life. Green (2019) introduces the term "tech goggles", which "warp behaviours, priorities, and policies according to the logic of technology." Like Greenfield, he describes the risk of oversimplifying people and the city's concerns, which often results in inadequate tech solutions that do not address root causes. One serious risk of utilising technology in governance is that it may reproduce social, institutional, and racial biases in its outcomes, as the data used to train algorithms often reflects these existing biases (Green, 2019). Therefore, technology must not be the driving force in a city's political and social reforms but rather a supporting tool. This indicates that participatory design is essential in shaping a future city's tech innovations. Furthermore, Green (2019) emphasises the importance of understanding the limitations of technology to protect our cities from its potentially detrimental effects.

4. Research Question and Methodology

While the discussion highlights some of Masdar City's shortcomings, it is important to note that the city is a work in progress. The analysis does not attempt to undermine the city's accomplishments but instead aspires to learn from the city's development process as an essential part of this project's methodology. Thus, upon examining Masdar City, several lessons can be derived. Primarily, experimenting on a large-scale means spending larger budgets to prove a concept that may not work in the first place. This reflects that working on smaller-scale research and development projects, perhaps on the neighbourhood scale, could be more efficient. Secondly, while technological development is inevitable, balancing technological interventions in the urban fabric is crucial, as Townsend, Greenfield, and Green highlight. Therefore, selecting and implementing reasonable tech solutions can be more sustainable and cost-efficient than developing full-scale innovations. Furthermore, Masdar City's business-oriented approach shows that focusing on economic sustainability is insufficient for a city to succeed; a more people-centric approach ensures a well-rounded interpretation of sustainability and its varying pillars.

Considering these lessons, we pose a significant question: How can we design a city that integrates technology into its urban fabric to promote and foster community values and connectivity?

To answer this question, a framework was developed as part of "MBL 537E: Architectural Design Futures", a graduate course at Istanbul Technical University. It consisted of analysing a case study of a future city, which in this paper is Masdar City, understanding its implications and features, and then implementing a design strategy on the grounds of a site in Florya, Istanbul. As Istanbul is no stranger to the effects of urbanisation, experimenting on its grounds could provide valuable insights. The comparison of Masdar City and Florya, Istanbul, allows us to envision and implement strategies to create a more inclusive city. The design framework for Florya is entitled "The Social City" and comprises four main approaches focused on public spaces, walkability, supporting local production and initiatives, and volunteering. Each approach consists of detailed, actionable goals that are comprehensively outlined.

5. “The Social City” for Florya, Istanbul

The project site, located in proximity to Florya’s residential area and public transportation facilities—namely the Marmaray train, the Metrobus line, and bus routes—is approximately 0.6 km² in size, which is ten times smaller than Masdar City (Figure 2). The site’s manageable scale and strategic location make it a reasonable experimentation spot, reducing the need for building entirely from scratch (Figure 3).

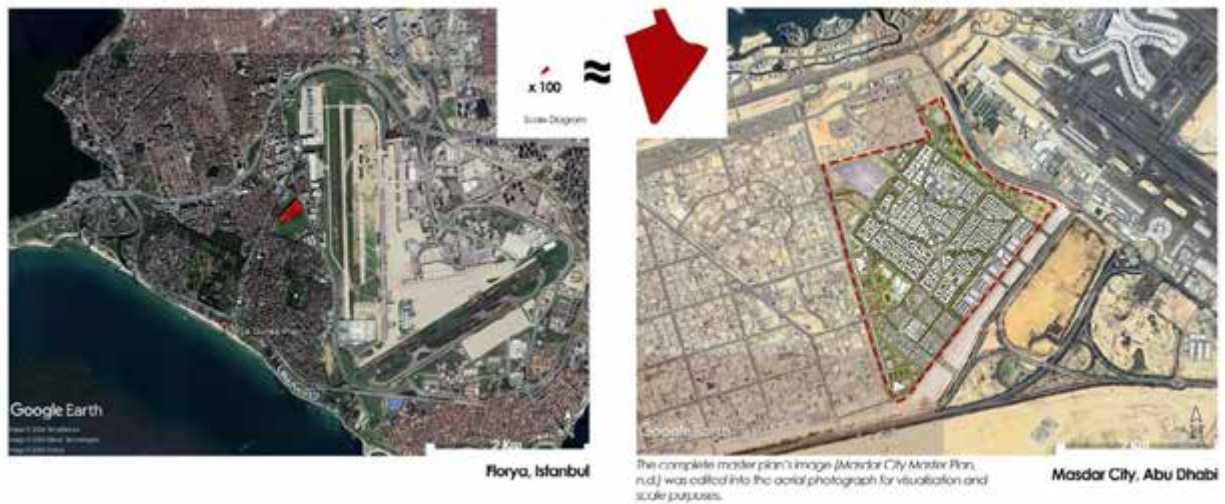


Figure 2: Florya and Masdar City's Scale Difference



Figure 3: The Selected Site in Florya, Istanbul

The Social City is a response to urbanisation and its negative consequences on community life to promote community and citizen well-being. The Social City aspires to strengthen community bonds and revitalise the sense of community and civic responsibility that has faded due to rapid urbanisation. It proposes a shift in urban thinking by transforming cities into smaller “smart villages,” promoting a model that fosters community engagement, social connection, healthier lifestyles, innovation, and community identity. Investing in a stronger, well-connected community helps support social sustainability, one of the often-neglected dimensions of sustainability, and positions it as a foundation for environmental and economic development. The Social City model aspires to put

people at the heart of urban planning while developing platforms and regulatory frameworks that ensure long-term sustainable living. Through people-centric, scalable technological interventions, The Social City provides an opportunity to explore how technology and urban design can work towards social sustainability in a city like Istanbul.

In metropolitan cities like Istanbul, scale and distance often form significant mobility and infrastructural challenges, which are reflected in the social dimensions of urban life and citizen well-being. This research proposes a smaller-scale urban model to address these challenges and create a more liveable and inclusive environment. The project aspires to develop a well-connected, walkable city by making all essential services and destinations accessible within walking distance. This way, the proposed model encourages walking and cycling, promoting healthy lifestyles.

This structure also strengthens the role of public squares and spaces as accessible community zones where different civic and cultural activities can be planned and organised through a digital citizen event-planning platform. Furthermore, the city is envisioned to be connected to the broader Istanbul metropolitan area via an integrated transportation system complemented by a digital mobility application that informs citizens of public transportation schedules and bus locations.

In addition, supporting local and small businesses is a primary goal in The Social City, where residents are provided with a platform that helps connect these community-based initiatives. This structure enables small businesses to flourish and provides revenue opportunities for underrepresented or economically disadvantaged groups through increased access to work and business potential.

To foster community engagement and promote civic responsibility, the model includes a volunteer-based platform where youth and residents can offer their time to support local needs. In return, participants are awarded social points to recognise their contribution. This system not only supports participants' educational and financial needs but also strengthens intergenerational ties and reinforces community identity.

The Social City is structured around four main approaches and strategies: **i. Dynamic Community-Centric Public Spaces, ii. The Walkable Grid for Green Mobility, iii. Local Business Empowerment Through Community, iv. Volunteering as a Bridge to Stronger Communities.**

5.1 Dynamic Community-Centric Public Spaces

Public spaces are paramount in connecting people; without such spaces, people cannot meet and socialise. As part of fostering community ties, providing well-located, well-designed public spaces that promote citizen interactions is essential to encourage people to socialise and interact with one another. Furthermore, by allowing citizens to play an active role in choosing and developing events of their interest, The Social City model can ensure that its public spaces are used effectively and inclusively. The key goals are designing central public spaces and city squares that are user-attractive and user-friendly and developing an app that provides citizens with the chance to be part of city events to promote citizen activity and interaction.

5.1.1 Designing central public spaces and city squares that are user-attractive and user-friendly

The city square serves as the city's main event and gathering space (Figure 4). As a well-served, accessible space with a central location within the heart of the city, everyone can participate in local events and enjoy the city spirit. Public spaces like walkways and courtyard spaces are meant to be green, walkable spaces where people can meet and socialise while hosting smaller-scale events at the neighbourhood scale (Figure 5).



Figure 4: The Social City's Main Public Square



Figure 5: The Social City's Open Spaces

5.1.2 Creating *The Social City Platform*, an app that provides citizens the chance to be part of city events, to promote citizen activity and interaction

Through *The Social City Platform*, citizens can suggest, organise, and vote for events of their interest (Figure 6). For large-scale events in the city square, citizens can share their ideas, which are later organised by the municipality. For small-scale events in local neighbourhoods, such as having a picnic, citizens can send a public invitation to a specific category. For example, an old lady wants to meet other women her age in her block. She can send an invitation to this category asking them to meet for tea in a specific public location. Furthermore, health-oriented events that promote socialising and connection, such as marathons, walking events, and sports activities, are to be highly promoted and encouraged. Citizens are encouraged to participate in these events and engage with one another through digital awards.



Figure 6: The Social City's Event App

5.2 The Walkable Grid for Green Mobility

This approach aims to provide a safe, green environment that promotes walking and cycling activities. Through a grid organisation and well-served central city artery, users are almost 5-15 minutes away from everything they could need. In addition, to promote the safe, social, and well-connected city model, the city is organised in a car-free grid with the peripheries and a main artery designed to serve as service and transportation zones. The key goals include creating a walkable city through a grid organisation, providing car-free lanes that encourage walking and cycling, and creating a mobility application for the city.

5.2.1 The walkable city through a grid organisation

The city is designed in a grid at a reasonable scale to enable users to navigate their surroundings easily while having different locations and target destinations within less than 15 minutes (Figure 7).



Figure 7: The Social City's Organisation & Dimensions

5.2.2 Providing car-free lanes and promoting cycling and walking activities while managing the peripheries and the city's main artery for a functional city model

The grid organisation and the scale of the city facilitate moving around and allow the grid's intersections to be car-free (Figure 8). The peripheries of the city, represented by the perimeter of the rectangular grid and its main central curved artery, allow vehicular access as part of the transportation strategy. While the city's policies do not promote private car ownership, users with cars or taxis can move around the grid's perimeter and central axis with one main parking space to the northern part of the master plan (Figure 9). The interior roads are designed to be utilised as service roads when necessary.



Figure 8: The Social City's Lanes



Figure 9: The Social City's Access Points

5.2.3 A mobility application to organise vehicular movement and public transportation with a regular schedule for demand-based supply

A mobility application will track people's movement patterns, their varying transportation activities, and the city's rush hours to tailor and provide transportation services accordingly. The app also allows users to track nearby buses' locations and The Social City's minibuses to plan their movement accordingly (Figure 10). The minibuses within The Social City provide access points to the surrounding neighbourhoods and Istanbul's public transportation, like Marmarav.



Figure 10: The Social City's Mobility App

5.3 Local Business Empowerment Through Community

The Social City aspires to empower citizens with small businesses or services. The “Thrive Local” platform is a local business platform that allows those with small businesses to operate via an e-store where they can sell their services. Users looking for a specific product or service may search for it and find locals who can provide it. This model encourages local production and strengthens social bonds by fostering the values of supporting small business owners and community empowerment. The key goals include creating the “Thrive Local” app and marketing the platform to support its usage.

5.3.1 The “Thrive Local” App

The “Thrive Local” app is a platform that aims to connect local business owners with local consumers to encourage local production and consumption. Thus, the app acts as a digital marketplace where users can browse different online businesses, search for various products or services, and talk to business owners for special requests and orders. Quality control is maintained through community rating and with the value of trust that the city aims to foster (Figure 11).



Figure 11: The Thrive Local App Model

5.3.2 Marketing the platform to encourage users to support local

To encourage users to support this socially empowering business model, citizens can receive coupons, discounts, and gifts based on how frequently they use the app and engage with online businesses (Figure 12).



Figure 12: The Thrive Local App's Marketing and Economic Sustainability Strategy
(This diagram was created with the help of Napkin AI)

5.4 Volunteering as a Bridge to Stronger Communities

Different social and age groups may need help from others. Whether you need help carrying some heavy groceries or moving around your furniture, The Responsible City Platform connects those who need help with available volunteers who are rewarded with social points and develop a good citizen score, which provides them with education and financial benefits. This promotes volunteering as an essential social value while rewarding citizens dedicated to social good. The key goals include creating "The Responsible City" volunteering platform, establishing the citizen score system, and ensuring safety measures for the volunteering system.

5.4.1 The Responsible City Volunteering Platform: Connecting those who need help with volunteers

Through The Responsible City Volunteering Platform, people in need of help can request the aid of a volunteer through the platform, which connects them to an available volunteer (Figure 13). This ensures that people who need help will have support from people who want to be active community members.

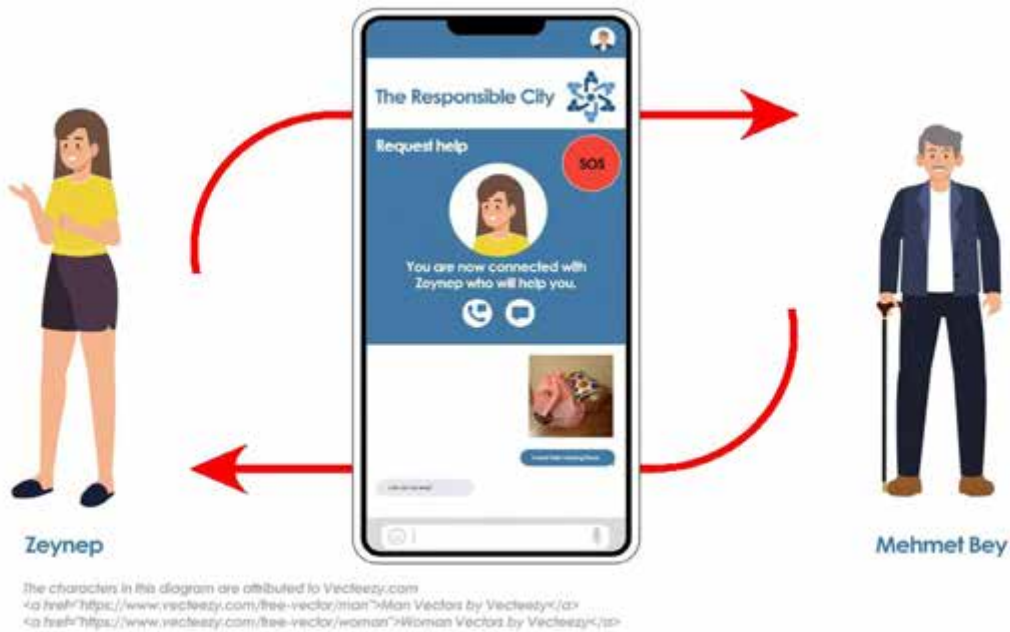


Figure 13: The Responsible City Volunteering Platform Model

5.4.2 The Good Citizen Score as a measure of volunteering activity

Citizens who actively engage as volunteers are rewarded with a good citizen score. The higher the score, the more benefits a citizen can acquire, ranging from financial support to educational fee support, discounts, and volunteering certificates (Figure 14). Furthermore, those who obtain high citizen scores can receive further training to “climb up” the social work and volunteering ladder and have a more effective social role and impact, potentially as a profession or with increased benefits. This fosters a volunteering environment that promotes civic responsibility, which enhances social bonds and connects people.



Figure 14: The Responsible City App Citizen Score and Benefits

5.4.3 Implement safety measures through volunteer training, user feedback, a point system, and tracking

To ensure the model's safety, interested individuals must attend training sessions to learn how to deal with different social and age groups before starting as volunteers. Furthermore, the Responsible City Volunteering app allows both volunteers and help recipients to offer feedback and explain their experiences. Users, whether volunteers or help recipients, acquire a score that reflects their honesty and integrity, and any users with questionable activity can be blocked from the app as a safety measure. Users are also tracked, and the app provides an emergency button if they feel unsafe and want to request help from a third party. Lastly, users may specify certain traits they seek in a volunteer, including gender and age (Figure 15).



Figure 15: The Responsible City App Safety Precautions and Measures (This diagram was created with the help of Napkin AI)

6. Conclusion

Through an experimental approach, this paper aims to propose a potential smart city model for the selected site in Florya, Istanbul, based on a thorough examination of one of the most prominent examples of a smart city: Masdar City. Taking into consideration the views of influential scholars like Green and Greenfield, the proposed model aims to focus on people and their varying needs while utilising technology to foster community bonds. At the same time, it seeks to adopt simple urban planning and design decisions to render the city more liveable and functional. The Social City helps envision a smart city without heavy technological infrastructure, with a focus on using mobile phones, which are highly available (Figure 16).



Figure 16: A Summary of The Social City's Approach (This diagram was created with Napkin AI)

As this project's approach was more exploratory and experimental, more attention was given to the ideation and innovation process. Thus, a more thorough investigation of the social construct in Florya is required to modify and tailor the proposed solutions accordingly. Further studies should revolve around understanding the community of Florya and their needs and concerns in the form of a participatory process to better understand how the proposed ideas could be integrated with the existing neighbourhood and society.

Initiatives like the "Thrive Local" app and "The Responsible City" volunteering platform advocate for a shift towards participatory and inclusive urbanism; however, potential obstacles, including safety and trust-related concerns, could hinder their progress or render them inefficient. Predicting how people would engage with new ideas is challenging; thus, testing such solutions before their full implementation is essential, and developing efficient and accurate testing methodologies for the proposed ideas could take "The Social City" a step further. Ultimately, The Social City in Florya, Istanbul sets the foundation for an approach that focuses on serving people and meeting community needs with technology.

References

- Cugurullo, F. (2013). How to Build a Sandcastle: An Analysis of the Genesis and Development of Masdar City. *Journal of Urban Technology*, 20(1), pp.23–37. doi:<https://doi.org/10.1080/10630732.2012.735105>.
- Cugurullo, F. (2016). Urban eco-modernisation and the policy context of new eco-city projects: Where Masdar City fails and why. *Urban Studies*, 53(11), pp.2417–2433. doi:<https://doi.org/10.1177/0042098015588727>.
- D'Eramo, A. (2021). Masdar city: a study of energy, infrastructure, and technological hope. *SMU Journal of Undergraduate Research*, 6(1), p.3.
- ESG 2023. (2023). [online] Masdar City Sustainability Reports. Abu Dhabi: Masdar City. Available at: <https://masdar-city.ae/sustainable-urban-development/sustainability-reports> [Accessed 3 Jun. 2025].
- Evans-Cowley, J.S. (2016). Review: The City of Tomorrow: Sensors, Networks, Hackers, and the Future of Urban Life By Carlo Ratti and Matthew Claudel. *Journal of Planning Education and Research*, 37(4), pp.498–499. doi:<https://doi.org/10.1177/0739456x16671399>.
- Fattah, H.M. (2007). Abu Dhabi Explores Energy Alternatives. *The New York Times*. [online] 18 Mar. Available at: <https://www.nytimes.com/2007/03/18/world/middleeast/18abudhabi.html>.
- Foster + Partners. (n.d.). Masdar City. [online] Available at: <https://www.fosterandpartners.com/projects/masdar-city>.

- Goldenberg, S. (2016). Masdar's zero-carbon dream could become world's first green ghost town. [online] the Guardian. Available at: <https://www.theguardian.com/environment/2016/feb/16/masdars-zero-carbon-dream-could-become-worlds-first-green-ghost-town> [Accessed 19 Oct. 2019].
- Green, B. (2020). *The Smart Enough City : Putting Technology in Its Place to Reclaim Our Urban Future*. Cambridge Massachusetts: Mit Press.
- Greenfield, A. (2013). *Against the Smart City*. New York City: Do Projects.
- Griffiths, S. and Sovacool, B.K. (2020). Rethinking the future low-carbon city: Carbon neutrality, green design, and sustainability tensions in the making of Masdar City. *Energy Research & Social Science*, [online] 62(101368), p.101368. doi:<https://doi.org/10.1016/j.erss.2019.101368>.
- Günel, G. (2014). Ergos: A New Energy Currency. *Anthropological Quarterly*, 87(2), pp.359–379. doi:<https://doi.org/10.1353/anq.2014.0026>.
- Ibrahim, I. (2016). Livable Eco-Architecture Masdar City, Arabian Sustainable City. *Procedia - Social and Behavioral Sciences*, 216, pp.46–55. doi:<https://doi.org/10.1016/j.sbspro.2015.12.070>.
- Masdar (2020). Masdar and Abu Dhabi Ports sign MoU to support Abu Dhabi Economic Vision 2030. [online] Masdar.ae. Available at: <https://masdar.ae/en/news/newsroom/masdar-and-abu-dhabi-ports-sign-mou-to-support-abu-dhabi-economic-vision-2030> [Accessed 2 Jun. 2025].
- Masdar City Master Plan. (n.d.). [online] masdar.ae. Abu Dhabi: Masdar City. Available at: https://masdar.ae/-/media/corporate/downloads/media/mas_mc_masterplan_flyer_2020.pdf?la=en&hash=46A5E85428C106459BC-46BE5C3FD1140483F2B1E [Accessed 7 Jun. 2025].
- masdar.ae. (2019). Masdar | Masdar City - A template for sustainable urban development. [online] Available at: <https://masdar.ae/en/news/newsroom/masdar-city---a-template-for-sustainable-urban-development>.
- masdar.ae. (n.d.). Masdar | Masdar City Solar Photovoltaic Plant. [online] Available at: <https://masdar.ae/en/renewables/our-projects/masdar-city-solar-photovoltaic-plant>.
- Omar, W.F. (2018). ZERO CARBON CITY- MASDAR CITY CRITICAL ANALYSIS ZERO CARBON CITY- MASDAR CITY CRITICAL. *BAU Journal - Health and Wellbeing*, 1(3). doi:<https://doi.org/10.54729/2789-8288.1053>.
- Premalatha, M., Tauseef, S.M., Abbasi, T. and Abbasi, S.A. (2013). The Promise and the Performance of the world's First Two Zero Carbon eco-cities. *Renewable and Sustainable Energy Reviews*, [online] 25, pp.660–669. doi:<https://doi.org/10.1016/j.rser.2013.05.011>.
- Ratti, C. and Claudel, M. (2016). *The city of tomorrow : sensors, networks, hackers, and the future of urban life*. New Haven ; London: Yale University Press, Cop.
- Report of the World Summit on Sustainable Development. (2002). [online] United Nations Digital Library. Johannesburg, South Africa: United Nations . Available at: <https://digitallibrary.un.org/record/478154?ln=en&v=pdf> [Accessed 3 Jun. 2025].
- Townsend, A.M. (2013). *Smart Cities : Big data, Civic hackers, and the Quest for a New Utopia*. New York: W.W. Norton & Company.