



CITIZEN-CENTERED GENERATIVE AI FOR URBAN TRANSFORMATION: THE AI COPACABANA DEMO CASE

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KEYWORDS	ABSTRACT
<i>Generative AI People-Centered Smart Cities ISC Model Strategic Design Thinking Well-being Sustainability Decentralization</i>	<i>This paper presents the development and real-world testing of AI Copacabana, a customized virtual assistant designed to operationalize the Innovation Model for Smart Sustainable Cities (ISC Model) by connecting the Local Innovation Map (LIM) with citizen-led actions. Validated at TRL5 in Copacabana, the prototype demonstrates how AI can act as a bridge between territorial diagnoses and community-driven initiatives—solutions that are decentralized, aligned with sustainable urban development goals, and integrated to impact local quality of life positively. Embedding a culturally familiar AI tool within participatory frameworks, the study illustrates new pathways for scalable, people-centered smart cities and sustainable urban innovation.</i>
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1. Introduction

According to projections by the United Nations (UN), by 2030, it is estimated that there will be 41 megalopolises with more than 10 million inhabitants (United Nations, 2014), and by 2050, the global population is expected to reach 9 billion, with approximately 70% living in urban areas (United Nations, 2019).

Reflections on urban development, however, are not new and have been present on global agendas for several decades, anchored in major worldwide debates, which have left legacy documents to guide policies and actions of different nations (Figure 1).

Figure 1. Global events and documents shaping sustainable urban futures



Source(s): Schiavo & Magalhães (2022).

While global challenges are exhaustively debated in the search for solutions, the population experiences a significant digital transformation at an accelerated pace, with new technologies being developed and integrated into daily life. This represents a historical phenomenon of cultural change triggered by the widespread use of information and communication technologies (ICT) in social, environmental, political, and economic practices. And while it provokes significant changes, it also opens up space to propose previously unimaginable alternatives.

The issues of urban development and digital transformation lead to the concept of Smart Sustainable Cities (SSC). These do not have an officially adopted concept (Schiavo & Magalhães, 2022), and in the context of this research, are not considered a final destination but rather an approach, or culture, that uses available technologies as tools to seek the well-being of people in cities and communities in a socially, environmentally, and economically sustainable way.

In recent years, however, the discussion has been that:

- Technological innovations - particularly in the field of Artificial Intelligence (AI)- are revolutionizing the way urban environments are planned, managed, and experienced (Street Art & Urban Creativity, 2025);
- Although technological innovations are advancing at a rapid pace, these advances have not been translated into significant socioeconomic impacts. As a result, we have digitalized, connected, and modern cities, but not necessarily smarter and more sustainable ones (World Intellectual Property Organization - WIPO, 2023); (World Intellectual Property Organization - WIPO, 2024);
- High investment in technology is not enough if the citizen cannot use it, does not see its applicability, or is not willing to adopt it (Batty, et al., 2012); and
- Across the globe, cities face the dual challenge of sustaining growth while ensuring quality of life for their citizens. Smart city agendas have often privileged top-down solutions, leaving limited room for citizen protagonism (Cugurullo & Xu, 2024).

Corroborating these findings, it can be concluded that investments in technologies aimed at making cities “smart” are not, by themselves, sufficient. It is essential to recognize citizens as

active agents in this process, capable of demanding changes and actions that respond to their needs both as users of urban services and infrastructure and as co-creators of transformations in their environment.

Despite significant technological progress and the increasing availability of data, a creative deficit persists in the responses to the core challenges that affect urban well-being.

Advancing toward sustainable urban development requires acknowledging territorial diversity and respecting distinct cultural and identity frameworks. This knowledge implies the incorporation of a new, transversal dimension—the project dimension—which refers to the collective capacity of cities (encompassing citizens, communities, governance structures, and institutions) to design innovations, anticipate scenarios, plan, conceptualize, visualize, prototype, implement, and learn from iterative processes.

Within this perspective, the Innovation Program for Smart Sustainable Cities (pISC), developed by the Design Management Laboratory of the Department of Arts and Design at the Pontifical Catholic University of Rio de Janeiro (LGD/dAD/PUC-Rio), emerges as a critical initiative. The program is grounded in the hypothesis that the field of urban innovation has been excessively driven by technological solutions detached from territorial realities, thereby overlooking the strategic, human, and experiential dimensions of urban development. It advocates for a paradigm shift that prioritizes decentralization, human needs, and everyday local life, focusing on context-specific problems and a sustainable development agenda aligned with local challenges (Figure 2).

Figure 2. PISC approach on Smart Sustainable Cities

✓ Decentralised (diverse actors)		✗ Centralised (privileged actors)
✓ People-centered		✗ Technocentric
✓ Address specific local problems and citizen needs	INSTEAD OF	✗ Serve demand-side interests and spur new business opportunities that do not align with the local context.
✓ Address local sustainable development agenda		✗ Address universal technical agendas (energy, transport, economy) even if they don't correspond to local priorities.

ISC Model | pISC | LGD Lab | PUC-Rio

Source(s): Elaborated by the author, 2023.

The program is grounded in the premise that local initiatives and decentralized solutions can be connected and multiplied, resulting in broader global impact and the creation of more sustainable systems. This reinforces the importance of local solutions in addressing global challenges (Manzini, 2015; Lerner, 2003; Hamdi, 2003).

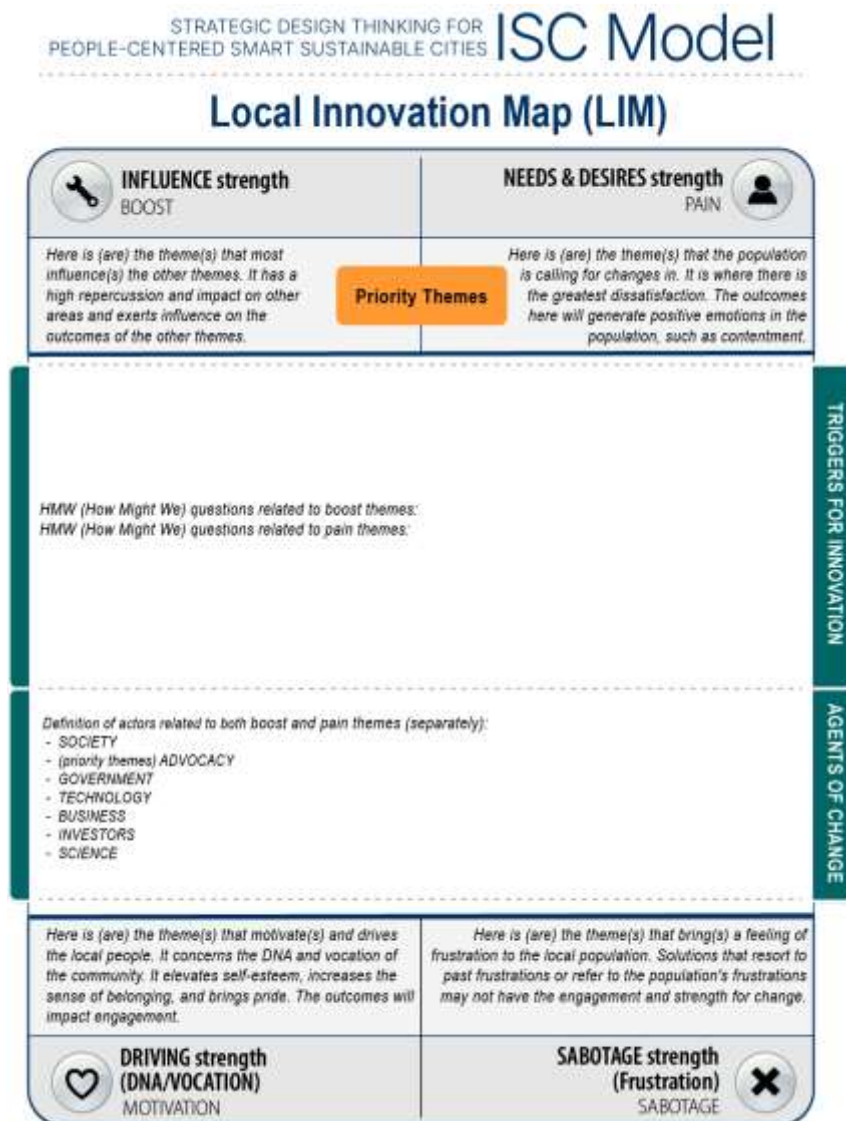
As an initial response, a methodology was developed to enable decentralized solutions that are simultaneously directed at real problems and capable of being developed by multiple actors - the Innovation Model for Smart Sustainable Cities (ISC Model). The Model was conceived at the LGD/dAD/PUC-Rio, in collaboration with the Copenhagen Business School, as a method based on Strategic Design Thinking to operationalize innovation in smart and sustainable cities, with a focus on well-being and citizen participation (Schiavo & Magalhães, 2024a) (Schiavo F. T., 2024).

The research question that guided the conception of the ISC Model was: “How can the Design Thinking process be used as a strategy for the development of projects for Smart Sustainable Cities?” The primary objective of the research was to design a model that employs the Strategic Design Thinking (SDT) approach in the development of projects for SSC, with a strong emphasis on people’s well-being and the sustainable development of cities and communities.

The proposed model was grounded in the guiding principles of SSC and based on the premise of “think globally and act locally.” It emphasized new approaches to community-oriented innovation at the neighborhood and urban district levels, prioritizing participatory methods. It sought solutions guided by the well-being of people and everyday life in specific territories. The testing of the model confirmed both its feasibility and effectiveness. The ISC Model was explicitly created to place the citizen at the center of innovation. It translates residents’ perspectives into actionable insights through design-based techniques that uncover root causes rather than relying exclusively on abstract or decontextualized datasets. This approach ensures that the lived realities of citizens are at the forefront of urban planning, making them feel valued and integral to the process.

One of the model’s main deliverables is the Local Innovation Map (LIM), which functions as a bridge connecting real-world problems to distributed solutions (Figure 3). It also plays a critical role in linking community realities with public policy frameworks. By structuring citizen priorities into clear and actionable innovation pathways, the LIM provides a shared reference point for dialogue among residents, policymakers, and institutional stakeholders. This articulation ensures that public policies are informed by grounded, community-driven insights, thereby fostering greater alignment between governance strategies and the lived experiences of urban populations.

Figure 3. ISC Model’s Local Innovation Map (LIM)



Source(s): Schiavo & Magalhães (2024a)

The first practical application took place in Copacabana, in a collaborative partnership with the Revival Copacabana¹ program and local organizations, with support from CAPES, the Brazilian Federal Agency for Support and Evaluation of Graduate Education (Schiavo & Magalhães, 2024b). This case serves as an inspiring example of the potential of collective action in driving urban innovation.

Among the outcomes was the Copacabana's LIM (figure 4), which captured residents' voices and priorities while incorporating innovation techniques to stimulate new solutions. The LIM is designed to guide innovative interventions, co-creation workshops, and strategic discussions with multiple stakeholders—residents, public managers, businesses, social organizations, and activists (Schiavo & Magalhães, 2023).

Figure 4. Copacabana's Local Innovation Map (LIM)



Source(s): Schiavo & Magalhães (2024c).

¹ Link available at: <https://www.minhacopa.com.br/>

The Copacabana's case demonstrated the ISC Model's capacity to generate tangible neighborhood-level transformations by combining open innovation, community empowerment, and alignment with the Sustainable Development Goals (SDGs 3, 10, 11, 16, and 17). The process also stimulated organizational cultural change: by transcending institutional boundaries and engaging diverse actors, it fostered a more participatory, resilient, and decentralized model of urban management.

This pilot consolidated the ISC Model as a scalable framework for other territories and served as the methodological foundation for the development of a virtual assistant, designed to democratize access to the method and to support communities and policymakers in creating local solutions for smarter and more sustainable cities.

The guiding question that followed was: How might we use Artificial Intelligence (AI) to bridge the gap between the LIM and multiple local agents of change, empowering them to act effectively toward a smarter and more sustainable territory?

The underlying hypothesis is that AI can operate as a bridging tool, linking the territorial realities consolidated in the LIM with the multiple solutions proposed by local actors, thereby enabling positive impacts on cities and communities, and improving quality of life within the broader agenda of sustainable urban development.

2. Literature Review

Based on the stated hypothesis, the literature review encompassed the role of AI in addressing the challenges of citizen participation in cities, considering the potential protagonism of the population in urban transformation within the context of smart sustainable cities.

Studies show that AI and citizen participation in digital platforms have been increasingly explored in the field of smart cities. One piece of evidence is the use of AI in Digital Participation Platforms (DPPs), which has enabled citizen empowerment and improved coordination between society and governments (Rossello et al., 2025).

Platforms such as OS City², coUrbanize³, Pol.is⁴, Zencity⁵, GoVocal⁶, CitizenLab⁷, Colab⁸, Ethelo⁹, among others, exemplify how AI and digital technologies are being applied to modernize public management, expand community engagement, and provide governments with a greater understanding of citizens' needs.

According to the articles reviewed, one of the main challenges faced by governments in online participatory projects is information overload (Arana-Catania et al., 2021). The large amount of data generated on these platforms makes it difficult for participants to find and understand each other's contributions, which can compromise both citizen engagement and interaction with policymakers (Chun & Cho, 2012). Moreover, asynchronous dialogues also reduce the effectiveness of large-scale citizen participation (Bono Rossello et al., 2024).

In this context, AI emerges as a promising solution to process data- both from the perspective of citizens and governments - and to improve the coordination of interactions (Hadfi et al., 2023). Applications include tools for automatic processing of contributions, classification of proposals, and summarization of content (Romberg & Escher, 2022; Arana-Catania et al., 2021). Recommendation systems have also been implemented to connect participants with similar ideas (Cantador et al., 2017), such as in the "Decide Madrid"¹⁰ platform, while collective analyses allow

² <https://osmartcity.appspot.com/>

³ <https://www.courbanize.com/>

⁴ <https://pol.is/home>

⁵ <https://zencity.io/>

⁶ <https://www.govocal.com/>

⁷ <https://www.impact.citizenlab.co/>

⁸ <https://www.colab.com.br/>

⁹ <https://ethelo.com/>

¹⁰ <https://decide.madrid.es/>

for the assessment of the overall dynamics of ideation processes (No et al., 2017). Individualized feedback, supported by natural language processing, enhances the alignment of contributions with the specific topics under discussion (Borchers et al., 2023).

Thus, recommendation systems and chatbots can simplify interactions on online platforms, making the experience more efficient and accessible (Ito, 2023). This technology opens unprecedented mechanisms for citizens to process data and explore participatory pathways with a direct impact on political activities (Savaget et al., 2019).

Other examples of initiatives that combine AI with citizen participation have been explored in projects funded by the European Union's Horizon 2020 and Horizon Europe programs. In these cases, AI is highlighted as a tool capable of fostering citizen participation in research projects, making science more accessible and effective (Campillo-Alhama et al., 2024). Its application enables the automation of complex or repetitive tasks, broadening access and allowing citizens to engage in research even without specialized training.

Another relevant point is AI's capacity to process and analyze large volumes of data, surpassing human limitations and contributing to more robust analyses in citizen science projects. The integration of AI with the knowledge generated through citizen participation opens the door to innovative solutions in fields such as health, environment, and sustainability (European Commission, 2024).

Despite the advances enabled by AI in citizen participation, some aspects still require improvement. Many solutions implemented in DPPs remain focused on technical challenges, such as summarizing and visualizing data for policymakers, while overlooking the social impact and the potential of AI to empower citizens (Romberg & Escher, 2022). This limited approach restricts the transformative role of technology, potentially neglecting both the representation of minorities and the formation of more informed citizens (Havrdá, 2020; Haqbeen et al., 2021; Savaget et al., 2019).

DPPs should be understood as socio-technical systems, encompassing not only technical functionalities but also social dimensions, including participants, discussions, interactions, and the broader political context (Bonina et al., 2021; Toots, 2019). Ignoring this hybrid nature can generate adverse effects, undermining both the effectiveness of the platforms and the performance of the AI tools applied within them (Selbst et al., 2019; Ehsan et al., 2021). The articles highlight the need for a more comprehensive AI design that goes beyond strictly technical aspects and incorporates social context, citizen empowerment, and the assurance of transparency, human control, and informational balance. These elements enhance the legitimacy and effectiveness of digital participation platforms, supporting and strengthening citizen initiatives aimed at urban transformation (Rossello et al., 2025).

It is evident that the use of AI for citizen participation in cities still focuses primarily on integrating these technologies into existing governmental or institutional digital platforms. While solutions such as enriched feedback and ideation feedback are being explored in other fields, their application in citizen participation remains rare (Bono Rossello et al., 2024). Furthermore, in the context of incentives for research and innovation projects, there is a clear need to address ethical and digital inclusion challenges to ensure that AI-mediated collaboration is conducted equitably and responsibly (Campillo-Alhama et al., 2024; Monje & Caballero, 2023; Solaiman et al., 2023; Franganillo, 2023; Sadin, 2020).

The theme of citizen participation remains challenging when the aim is to position citizens as protagonists in the creation of new solutions, rather than merely as supporting actors in ongoing processes. Listening to citizens represents progress, but transforming them into agents of concrete changes that directly impact their territories is still a largely unexplored field. There is a noticeable absence of references to citizens who have developed their own AI tools to promote urban change autonomously, as well as a lack of systematized examples of change makers who have applied artificial intelligence in bottom-up initiatives independent of formal governmental structures. The structured and scalable use of AI as a driver of decentralized solutions, yet aligned with major urban challenges, remains a central challenge for contemporary urban innovation.

This project specifically seeks to address this gap by investigating pathways to bring AI closer to ordinary citizens, enabling them to use it as an individual support tool for generating real and transformative impacts in their city or community.

In addition, it is also essential to consider recent advances in digital participatory methodologies, whose insights further strengthen the theoretical underpinning of this study. Recent scholarship highlights how generative artificial intelligence (GenAI) is increasingly integrated into participatory practices to enhance citizen engagement in sustainable urban innovation. These approaches leverage large language models (LLMs), AI-generated imagery, and hybrid digital-offline platforms, fostering more inclusive, scalable, and interactive participatory processes (Guridi et al., 2024; Zhou et al., 2024). Empirical case studies across North America, Europe, and Asia demonstrate how such technologies mediate citizen collaboration, enabling the co-creation of urban solutions that balance social, environmental, and economic goals.

Methodologies employing AI-enabled workshops, multi-agent simulations, and digital twins empower diverse stakeholder groups, including marginalized communities, to engage in urban planning with unprecedented depth and reach (Ng et al., 2023; Yu, 2024; Coors & Padsala, 2024). These advancements facilitate richer spatial dialogues, intergenerational participation, and real-time urban scenario testing, significantly enhancing decision quality and participatory satisfaction.

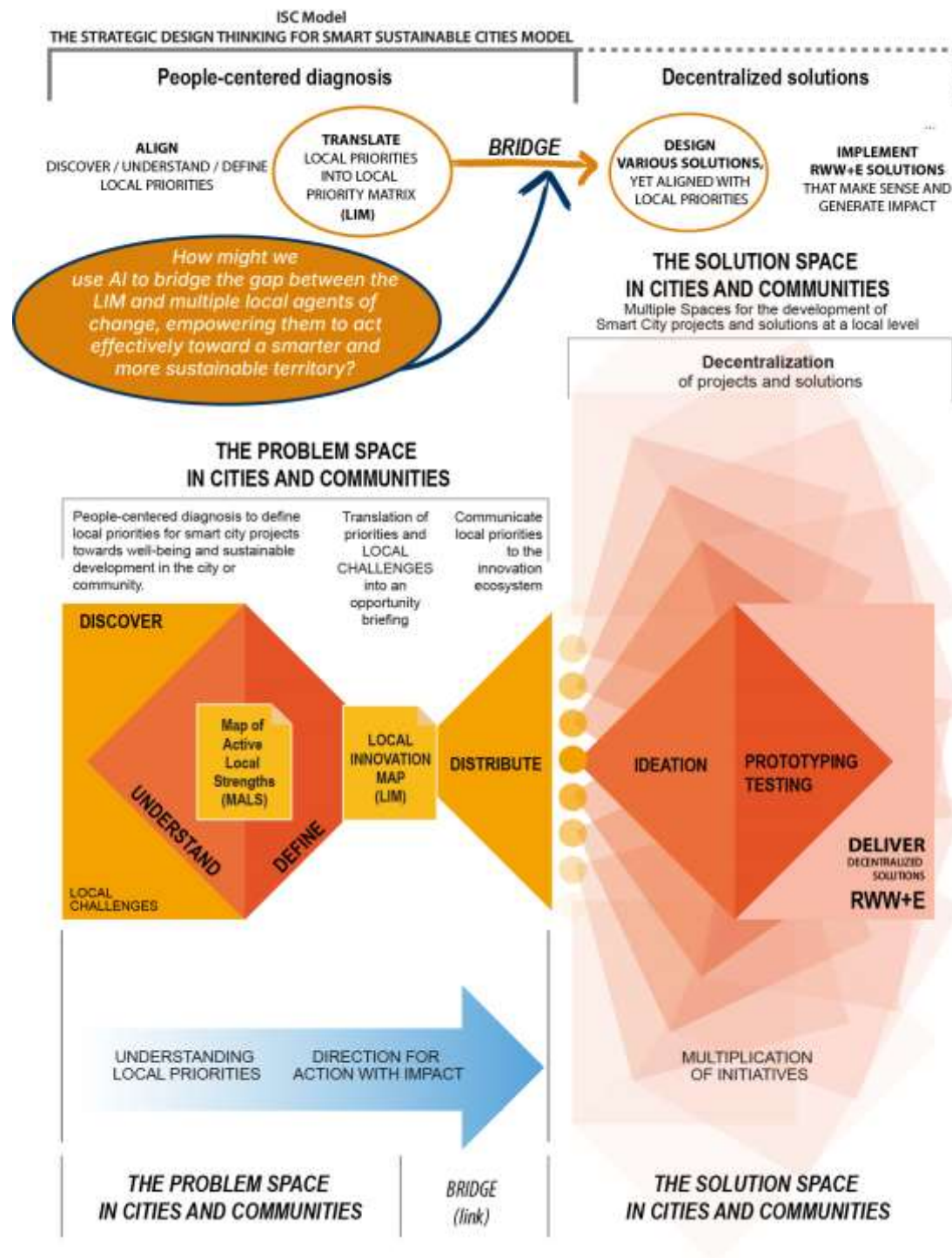
However, challenges remain regarding digital equity, algorithmic biases, and the ethical governance of AI tools. These issues necessitate a deliberate design that emphasizes transparency, human oversight, and inclusiveness to prevent reinforcing existing social disparities (Williams et al., 2024; Gowaikar et al., 2024; Marji et al., 2024). Furthermore, integrating digital platforms with traditional in-person engagement efforts has proven essential to building community trust and sustaining meaningful participation (Yang et al., 2024).

Finally, contributing to this emerging domain by exploring the potential of a citizen-centered AI virtual assistant to bridge technological solutions with grassroots urban initiatives is also a key aspect of this project. By empowering individuals to generate and implement context-relevant projects autonomously, this work addresses the identified gap in scalable, bottom-up AI applications, thereby fostering decentralized and sustainable urban transformations.

3. Objectives

The objective of this applied research project is to propose an AI-based solution capable of fostering multiple local initiatives that are relevant, transformative, and feasible, led by community representatives. The central challenge lies in connecting the Local Innovation Map (LIM) with individuals interested in initiating projects or implementing actions that positively impact quality of life in their communities, while simultaneously providing technical support for the effective structuring and implementation of these initiatives (Figure 5).

Figure 5. Strategic Design Thinking process of the ISC Model



Source(s): Schiavo & Magalhães (2024a)

4. Methodology

To address the central challenge, the methodology combined the foundations of the ISC Model with the development and experimentation of a customized AI Virtual Assistant. The process sought to translate the Local Innovation Map (LIM) into an accessible interaction flow, enabling community diagnoses to be directly connected with citizen-led actions. The sequence of activities unfolded progressively, starting from the decomposition of the LIM to generate the assistant's

briefing, followed by prototype creation, testing, public engagement, feedback collection, and iterative refinements. This approach not only validated the solution in real conditions but also provided lessons to guide its future evolution.

4.1. Decomposition of the Local Innovation Map (LIM)

The first stage involved breaking down the LIM generated by the ISC Model to create a detailed briefing description. Its foundations provided both the conceptual structure and operational logic for connecting territorial diagnoses with community-driven innovation. This briefing served as the basis for designing the interaction flow of the customized AI assistant, ensuring alignment with the priorities and realities identified by residents.

4.2. Prototype Creation and Coding

Based on the briefing, a prototype of the assistant was developed and codified using OpenAI's GPT framework. The customization process involved creating conversational scripts, establishing behavioral constraints (e.g., sequential flow of questions, mandatory RWW+E validation), and curating content directly derived from the LIM. These coded features ensured that the assistant could provide contextually relevant, actionable, and feasible responses, while maintaining consistency with the ISC Model's citizen-centered principles.

4.3. Prototype Testing and Data Collection

Initial functionality tests were conducted to verify accessibility, clarity, and user interaction dynamics. Due to the age profile in Copacabana, where more than one-third of the population is 60 years old or older (Schiavo, 2024), particular attention was given to elderly participants, who were more likely to face challenges in digital interactions. These tests aimed to identify usability barriers, detect technical issues (such as difficulties completing interaction steps), and ensure that participants could conclude the process with a structured action plan. Additionally, tests were conducted to identify opportunities for enhancing the assistant's responsiveness.

Data collection tools included direct interaction with participants during pilot sessions, with a focus on older residents to identify age-related usability barriers; informal conversations that provided contextualized insights into user perceptions and difficulties; and observation of technical barriers, such as interruptions that prevented participants from completing the interaction.

Two key qualitative criteria were used to analyze the prototype: usability, referring to the clarity and simplicity of the interaction flow; and accessibility, referring to the ability to include participants with diverse levels of digital literacy.

A critical marker of success was whether participants could complete the interaction and generate a structured action proposal ready for execution.

This qualitative approach allowed the research team to capture real-time impressions and identify usability issues. Information was used to develop AI behavior and interaction flow.

4.4. Public Engagement and Feedback Collection

The prototype was presented in a public event to assess acceptance and trust. Feedback was gathered through direct interaction, informal conversations, and observation of difficulties during the process. Participants' impressions and acceptance were collected to measure possible skepticism and resistance regarding the role of AI tools in professional or community contexts. Considering the goal of capturing perceptions of usability, skepticism toward AI, and technical barriers that could prevent completion, this stage revealed important insights into which kind of support communication strategies would need to be developed in future stages. Also, qualitative insights informed decisions about adjustments in the assistant's design, such as reframing introductory prompts to provide more explicit usage guidance.

4.5. Iterative Simulations and Refinements

Following the feedback, simulations were conducted to test different interaction scenarios. Iterative adjustments were made to enhance the assistant's usability, accuracy, and ability to guide citizens in structuring projects and actions, particularly in the conversational flow, by refining initial icebreakers into clearer instructions. Distinct user profiles (e.g., elderly residents, young entrepreneurs, busy executives, and artists) were simulated, allowing the assistant's adaptability to be tested against different capacities for action. Each cycle of feedback and refinement strengthened the assistant's ability to guide participants in structuring projects and actions anchored in the LIM, besides reinforcing the inclusiveness of the prototype.

4.6. Methodological Systematization

The methodological pathway was validated at TRL5, combining strategic design and real-world prototyping. Data collection relied on direct interaction with users, focusing on the completion of proposed tasks and the perceived ease or difficulty of reaching an actionable outcome. The primary criteria for analysis were usability, accessibility, alignment with the LIM, and compliance with the RWW+E framework, ensuring that proposed actions were realistic, technically feasible, financially viable, and environmentally responsible. A key marker of success was whether participants could reach a finalized action plan ready for execution. Validation mechanisms involved iterative adjustments based on individualized feedback and cross-profile simulations, ensuring robustness and transferability of the results.

4.7. Lessons Learned and Next Steps

The initial Copacabana Demo confirmed the feasibility of embedding AI in citizen-driven innovation processes. The iterative design improved contextual sensitivity and progressively aligned the assistant with user expectations. These lessons provide a foundation for advancing toward more robust versions of the assistant, expanding its application scope, and exploring pathways for scalability and integration with complementary tools.

5. Results and Analysis

In response to the challenge of proposing an AI-based solution capable of fostering local initiatives that are relevant, transformative, and feasible, and led by community representatives, a Customized Virtual Assistant for Urban Transformation was developed to be easily accessed and used by citizens interested in improving their neighborhoods: the AI Copacabana Demo Case¹¹ (from now, referred to as AI Copacabana). The central objective was to connect LIM with individuals willing to initiate projects or implement actions that positively impact the quality of life in their communities, while simultaneously providing technical support for the effective structuring and implementation of such initiatives.

The OpenAI ChatGPT platform was deliberately selected as the foundation for this prototype, not only due to its popularity in Brazil but also for its capacity to act as a mediator between diagnostic data and citizen action. By leveraging a widely known and culturally familiar tool, the project successfully overcame one of the most common barriers to AI adoption: the steep learning curve associated with understanding and operating new technologies. This solution ensured that the LIM, generated through the ISC Model, could be directly accessed by any individual wishing to undertake, initiate projects, or engage in local action for Copacabana. In practical terms, this created an unprecedented possibility: "anyone who wants to do something" for their neighborhood could interact with real, citizen-derived data and receive structured support to transform local needs into feasible solutions.

¹¹ Available at: <https://chatgpt.com/g/g-682f4225349081919b241ccfb56dab80-reavivar-copacabana-demo-sintese-v1>

The assistant not only presented information but also guided residents in structuring actionable plans aligned with four essential criteria: a) addressing the needs identified by the community itself; b) ensuring technical feasibility; c) demonstrating financial viability; and d) incorporating environmental responsibility. This holistic framework—defined as RWW+E: Real, Win, Worth, and Environmentally Responsible—transformed the LIM into a dynamic tool for community-driven planning, enabling localized solutions that were both grounded in citizen perspectives and scalable for broader impact.

By embedding the LIM within this familiar AI interface, the project democratized innovation processes and encouraged inclusion, ensuring that even individuals with limited digital skills could participate effectively.

Finally, the customized AI was tested in Copacabana, which once again served as an urban living lab for experimentation and validation. This application not only represented a practical response to the project's objective but also positioned the solution at Technology Readiness Level 5 (TRL5), as it was validated through pilot implementation in a real urban environment. The results demonstrate the feasibility of using AI-based tools to bridge innovation methodologies with citizen-led actions at the community scale, while also confirming its potential for broader adoption and scalability.

The first public demonstration of AI Copacabana took place during the MLB Forum 2025, an annual event organized by the local social organization Rio 50+, which brings together residents and community leaders. The event included a live tutorial of the AI assistant, from the initial QR code access to step-by-step interactions aligned with the themes identified in the Local Innovation Map (LIM). Participants who wished to engage could interact directly with the assistant on their own devices, while others followed the guided simulation presented live. Although connectivity issues limited individual interaction for some, the collective experience effectively demonstrated how the tool could be used to address local priorities.

This public exercise revealed both the potential and the challenges of the prototype. In addition to the live walkthrough, complementary simulations were conducted with distinct user profiles, as an elderly resident, a young entrepreneur, a busy executive and an artist.

The four simulated cases illustrating interaction with the AI Copacabana are described below.

To begin with, some points common to all four examples presented in this article need clarification. AI Copacabana starts with the message: "I am a virtual assistant for strategic innovation. I'm here for a quick demonstration of how I can help you think of solutions for Copacabana that align with your field of action and possibilities, while also following the concept of smart and sustainable territories."

The initial questions - generally used as icebreakers - were repurposed to clarify points that generated confusion among users during testing:

- Hello! Great to have you here. Shall we begin?
- No need to ask a question, since the chat displays a default message: "ask something."
- Just reply "yes" or "no" in the chat below.
- If "run.mocky.io" appears, allow it. It is part of the process!

All users were presented with the same priority themes for Copacabana as defined in the LIM and were asked which they preferred to take action on:

- Safety on the streets (roads, sidewalks, and access).
- Feeling safe when walking alone.
- Civic education.
- Environment (squares, greenery, sewage in the sea).
- Urban cleanliness.
- Relocation and dignified care for people experiencing homelessness.
- Organization and regulation of public spaces and roads.

Participants were then asked to reflect on how they could act, choosing from:

- Through their work.
- Through their hobby.
- Through financial investment.
- With their time.

– Other.

After identifying feasible actions aligned with each user's profile, they all went through the RWW+E verification step, where they had to evaluate whether their proposed action remained technically feasible, financially viable, and environmentally responsible.

In other words, users reflected on how confident they felt to act safely, affordably, and with respect for the urban environment.

Once the action met all key feasibility criteria, AI Copacabana supported the user in structuring a personalized action pathway based on their goal. Finally, the tool also offered assistance in developing the complete action plan.

5.1. AI Copacabana simulated case 1: an elderly resident

The simulation involved a 65-year-old female resident of Copacabana, who engaged with the system using the priority themes previously identified by a research project carried out at PUC-Rio on local strengths and vulnerabilities. It is essential to highlight that the neighborhood is known in Rio de Janeiro for containing one of the most significant portions of the elderly population in the city. In 2022, residents aged 60 or more comprised more than one-third of the neighborhood's population, with the perspective of reaching more than half of the local population by 2050¹².

At the beginning of the interaction, the participant was invited to select one of the seven priority themes for the neighborhood. She chose to address "Organization and regulation of public spaces," considering it especially relevant for improving the quality of life in her community. The system then asked how she would be able to contribute. The resident declared that she was willing to contribute her time and specified that she could dedicate two hours per day to the proposed activities.

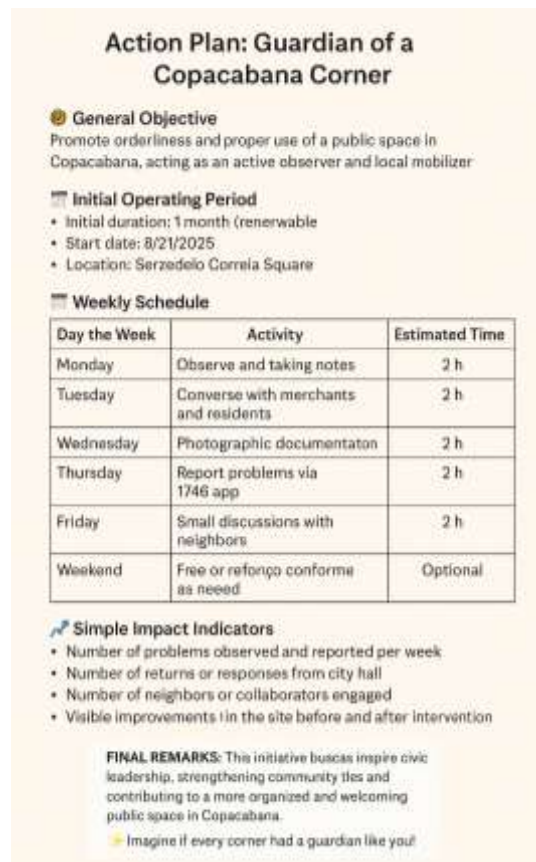
Based on this input, the chat presented a set of possible community actions connected to the chosen theme. The participant opted to act as a "guardian of a square or street corner," taking on the role of local observer and mobilizer. This option was validated for technical, financial, and environmental feasibility, with the participant confirming her ability to perform the role safely and effectively.

Subsequently, the system generated a personalized action pathway named "Corner Guardian." This included steps such as selecting a specific public space, daily observation and registration of behaviors, reporting issues through official city channels, creating ties with local residents and shopkeepers, and sharing results with the community. The participant agreed to advance with the pathway, and the chat consolidated a summarized version of the action plan to share (Figure 6). The chosen location was Praça Serzedelo Correia, with an initial period of one month, a weekly activity schedule, and simple impact indicators, including the number of reported issues, responses from the municipality, engagement of neighbors, and visible improvements in the urban environment.

The simulation highlighted the capacity of the prototype to translate individual intentions into concrete, structured, and feasible plans of civic action, reinforcing the perception of community protagonism. Throughout the interaction, the participant showed consistent engagement and a genuine willingness to implement the proposed initiative in her neighborhood. This experience demonstrates the potential of interactive digital technologies to stimulate social participation by transforming urban transformation agendas into accessible and achievable practices aligned with the daily realities of local residents.

¹² Available at: <https://www.data.rio/documents/ba877d53302346eca990a47c99e15f74/about>. Accessed em 15/out/2023.

Figure 6. Guardian of a Copacabana Corner: action plan generated by AI Copacabana (Case 1 simulation)



Source(s): Own elaboration, generated by AI Copacabana Demo (2025).

5.2. AI Copacabana simulated case 2: a young entrepreneur

This report describes a simulation conducted with the prototype of *Copacabana AI*, focusing on the experience of a 24-year-old resident of Copacabana who presented himself to start an entrepreneurial initiative in the neighborhood.

Among the priority themes presented, the participant chose to develop initiatives related to the environment. This theme encompasses the care of public squares, urban tree planting, and issues of pollution and sewage in the sea. When asked about the form of contribution, the young resident indicated that he wished to act through his professional work, declaring his interest in entrepreneurship in the field of technology, with particular emphasis on drones, games, and extended reality, while seeking a connection with the Blue Economy on Copacabana beach.

Based on this choice, the system suggested several technology-driven environmental actions, including the use of drones to map marine pollution, the creation of educational augmented reality games, and the development of a “digital adoption” app for the beach, integrating environmental sensors and citizen participation. The participant selected the third alternative, considering it the most promising to generate both environmental impact and community engagement.

When questioned about the financial feasibility of the idea, the young entrepreneur acknowledged the need to secure resources through innovation funding calls. The system then presented a detailed overview of potential support mechanisms, including FINEP programs (such as public calls and Finep Startup), EMBRAPPI, PIPE, the ICT Law, as well as regional calls and social innovation initiatives such as Oi Futuro. From this comparative analysis, the participant decided

to pursue a rapid prototyping pathway, which aligned most closely with the PIPE program (Innovative Research in Small Businesses).

The interaction then advanced to the construction of a draft project proposal. The plan was titled “Copacabana Beach, Alive” (Copacabana Praia Viva, in Portuguese) and was structured with objectives, justification, methodology, target audience, timeline, technical team, and estimated budget (Figure 7). The proposal included the development of an MVP of the application, the integration of IoT sensors and drones for environmental monitoring, the creation of gamification mechanisms to encourage community engagement, and the establishment of partnerships with local schools and NGOs. Expected outcomes were also defined, including the engagement of 500 users in the pilot, the reduction of waste hotspots along the beachfront, and the production of georeferenced data on critical points requiring cleaning.

Finally, the system supported the preparation of a one-minute pitch for presentations to evaluators and potential partners, emphasizing the innovative character of the initiative, its social and environmental impact, and the replicability of the solution for other urban beaches.

The case highlights the potential of the AI Copacabana Chat as a mediation tool between individual entrepreneurial intentions and concrete opportunities for territorial innovation. The experience demonstrated not only the system’s capacity to guide the user in choosing a course of action aligned with local priorities but also its strategic role in connecting emerging projects with innovation funding mechanisms, thereby strengthening the nexus between technology, sustainability, and citizen participation in the urban context.

Figure 7. “Copacabana Beach, Alive”: action plan generated by AI Copacabana (Case 2 simulation, young entrepreneur)

PRAIA VIVA COPACABANA											
Digital Beach Adoption App Prototype											
PROBLEM / CHALLENGE Challenges related to litter, marine pollution, and natural area maintenance.	GENERAL OBJECTIVE Developing a functional prototype of a digital beach adoption app										
SPECIFIC OBJECTIVES	• Create critical litter points and environmental degradation using drones and sensors • Implement an alert system and point-based system for citizen engagement • Establish partnerships with local schools, associations and NGOs for pilot										
• Create a functional MVP focus on the Copacabana shoreline • Map critical litter points and environmental degradation using drones and sensors • Implement an alert system and point-based system for citizen engagement • Establish partnerships with local schools, associations, and NGOs for pilot	SUMMARY CHRONOGRAM										
EXPECTED OUTCOMES	• John Doe (developer, coordinator) • External environmental consultancy • Freelancere back-end programmer • Volunteer or scholarship UX interface (per scholarship)										
• Engaging at least 500 local users in the pilot • Reduce litter hotspots in monitored areas • Geo-referenced data collection of critical cleanup points • Technical basis for expanding to other Rio's coastal neighborhoods	ESTIMATED BUDGET										
	<table> <tr> <td>MVP development</td><td>\$12,000</td></tr> <tr> <td>Basic sensors + drones</td><td>\$8,000</td></tr> <tr> <td>Communication + artwork</td><td>\$3,000</td></tr> <tr> <td>Costs operational/ testing expenses</td><td>\$5,000</td></tr> <tr> <td>Total</td><td>\$28,000</td></tr> </table>	MVP development	\$12,000	Basic sensors + drones	\$8,000	Communication + artwork	\$3,000	Costs operational/ testing expenses	\$5,000	Total	\$28,000
MVP development	\$12,000										
Basic sensors + drones	\$8,000										
Communication + artwork	\$3,000										
Costs operational/ testing expenses	\$5,000										
Total	\$28,000										

Source(s): Own elaboration, generated by AI Copacabana Demo (2025).

5.3. AI Copacabana simulated case 3: a busy executive

The simulation involved a 45-year-old businessman, married and father of two daughters, who lives in Copacabana and holds an executive position in a multinational company. He presented himself to contribute financially to improve the neighborhood.

When asked to choose among the local priority themes, he selected Safety on Copacabana's streets (roads, sidewalks, and access routes). The system then explored the forms of contribution available, and he indicated willingness to contribute through financial resources, specifying an individual monthly investment of up to R\$1,000.

Based on this profile, the system proposed a set of possible contributions aligned with the chosen theme: financing smart lighting in critical areas, covering the maintenance costs of community surveillance cameras, investing in local security-tech startups or collaborative monitoring apps, supporting educational campaigns on the responsible use of public spaces, and funding signage or street-painting initiatives. The participant opted for a combined approach: supporting local startups focused on urban security and financing citizen education campaigns.

To advance this choice, the system presented him with a menu of concrete actions. He first considered directly financing a community monitoring app for Copacabana and confirmed its technical feasibility, financial viability, and environmental responsibility. However, given his lack of available time to map and engage with startups personally, he emphasized the need for a "ready-to-go" solution where he could simply transfer funds to an existing initiative.

Taking this into account, the system adjusted the action pathway, recommending a low-operational-involvement model, in which his contribution would be directed to reliable and established organizations. Suggestions included supporting the Local Community Safety Council (CCS), *Viva Rio* NGO, or *Soluções Urbanas* NGO. After a comparative analysis of their scope and reliability, the participant chose to support the CCS, recognizing its legitimacy as a formal channel connecting residents, civil society, and public security forces.

The system then provided a ready-to-use template message for formal contact and shared verified communication channels with the CCS, allowing him to establish the partnership directly and securely. The final action plan included monthly recurring financial support of up to R\$1,000, the establishment of simple reporting mechanisms, and the possibility of encouraging other residents to join the initiative, thereby amplifying its impact.

This case (Figure 8) illustrates the potential of AI Copacabana to align individual financial intentions with structured and credible community initiatives. By reducing barriers to engagement - particularly for citizens with limited time but significant resources - the system effectively translated willingness to contribute into actionable support for urban safety, reinforcing both community trust and the sustainability of local innovation ecosystems.

Figure 8. Summary of action framework for AI Copacabana simulated case 3 (a busy executive)

Summary Action Framework

Element	Description
Contributor Profile	Man, 45 years old, married, father of two girls, resident of Copacabana, director in multinational
Priority Theme	Safety on Copacabana streets (roads, sidewalks, and accessways)
Contribution Method	Financial - up to \$1,000.00 per month, individually
Chosen Action Type	Direct support to local urban security innovation fund
Selected Partner Initiative	Community Security Council (CSC) Copacabana-Leme
Action Objective	Contribute to coordinated civic safety and community technology projects
Execution Mode	Direct transfer of monthly resources, no operational involvement
Next Step	Send formal message to CSC via email (ccsisp@gmail.com) or WhatsApp (21 98596-5241)

Source(s): Authors, generated by AI Copacabana Demo (2025).

5.4. AI Copacabana simulated case 4: an artist who plays beach tennis as a hobby

The simulation involved a 32-year-old artist living in Copacabana, who engaged with the system to explore how she could contribute to improving her neighborhood.

When asked to select among the seven priority themes for Copacabana, she also chose "Safety on the streets (roads, sidewalks, and access routes)", as the 45-year-old businessman. The system framed this theme as a "Force of Influence," meaning that interventions in this area could generate positive spillovers for other aspects of neighborhood life. The artist was then invited to define the form of her contribution. Instead of her professional work, she opted to act through her hobby, which she revealed to be playing beach tennis.

The system explored this angle and suggested ways of connecting her hobby with the chosen theme. She explained that she regularly plays beach tennis on Tuesday and Thursday mornings, as well as on weekends, and could dedicate two extra hours per week to community action. Based on this availability, the system presented several possible initiatives: organizing inclusive sports gatherings with a safety focus, creating artistic visual signage along access routes, building a vigilant network of players sharing alerts, raising awareness before or after matches, or activating a "safe beach" project integrating different sports practices.

She chose the third option: forming a network of vigilant beach tennis players. The system then helped refine this into a practical and specific action—creating a WhatsApp group among players to share safety alerts, safe routes, and good practices. This solution was validated as technically possible, financially viable, and environmentally responsible, and the artist confirmed her readiness to implement it.

A personalized action pathway was then proposed (Figure 9). It included mapping contacts, creating the WhatsApp group with a suggested name (Beach Tennis Copacabana – Safe Network), sending a welcome message, establishing simple guidelines for sharing information, scheduling short weekly check-ins, inviting new players regularly, and documenting perceived impacts. The system emphasized that even such a simple measure could strengthen the feeling of safety and community trust in the neighborhood.

Figure 9. Summary of AI Copacabana simulated case 4 (an artist using beach tennis as a hobby)



Source(s): Authors, generated by AI Copacabana Demo (2025).

Finally, the artist requested to formalize a complete action plan, including communication materials to recruit participants. The plan, titled “Beach Tennis Copacabana – Safe Network”, outlined objectives, timeline, and monitoring indicators (such as number of participants, frequency of useful messages, and perceived improvements in safety). It also included ready-to-use texts for printed posters, flyers, and social media posts, as well as the step of designing a visual identity and layouts, which the artist, given her background, would create herself.

This case illustrates how the system can creatively adapt individual lifestyles and hobbies into meaningful civic contributions. By transforming a recreational practice such as beach tennis into a platform for building community vigilance and trust, the prototype demonstrated its capacity to translate personal engagement into structured collective action, reinforcing the link between everyday life, urban safety, and citizen participation.

5.5 Analysis

These examples illustrate the versatility of the assistant, capable of adapting its responses and structuring solutions according to different profiles, interests, and levels of engagement with territorial transformation.

AI Copacabana enabled joint analysis between the user and the assistant, supporting the construction of solutions within the RWW+E framework. The system not only provided initial ideas but also guided the structuring of actionable plans aligned with the reality of each change agent, thereby enhancing the multiplicity of local solutions anchored in the LIM diagnosis.

Most importantly, the demonstration confirmed the guiding principles of the ISC Model: citizen engagement, technological accessibility, and tangible local impact. It also consolidated the project as a TRL5 prototype, validated under real community conditions. By combining a culturally familiar AI interface with locally grounded perceptions, AI Copacabana showed how generative AI can bridge the gap between territorial knowledge and practical action, transforming citizens into active agents of urban innovation.

Another relevant point was the comparison between the results of the ISC pilot ideation phase, based on co-creation workshops in a presential format, and those obtained through the AI-based approach. On average, a workshop with around 30 participants, organized into four groups, produced four structured projects in the form of business plans. While this traditional method demonstrated effectiveness, it limited the number of solutions generated. In contrast, the AI-based approach produced an exponential increase in the variety of possible solutions, reinforcing the ISC Model’s objectives of decentralization and multiplicity of outcomes.

From the perspective of iterative processes and analytical insights, the development methodology proved essential for refining the Copacabana Demo. Feedback collected throughout training sessions and pilot testing revealed three main challenges. First, limitations in GPT customization created difficulties for users unfamiliar with initiating conversations with AI; some mitigations were adopted, such as reframing initial icebreaker prompts into practical usage guidance, but greater flexibility in message customization would enhance functionality and improve user experience. Second, reduced functionality in free versions constrained the assistant’s capacity to sustain more advanced interactions, often resulting in incomplete activities. Third, the lack of integration with auxiliary applications—such as forms or collaborative tools—limited the translation of planned actions into effective execution.

Despite these constraints, the iterative approach ensured progressive adaptation of the assistant to the local user profile, enhancing both accessibility and alignment with community expectations. More importantly, it reinforced the guiding principles of the ISC Model—citizen engagement, technological accessibility, and tangible local impact—while demonstrating the feasibility of embedding AI into citizen-driven urban innovation processes.

The analytical insights from these tests confirm that citizen-centered AI for cities, coupled with robust diagnostic frameworks like the Local Innovation Map, can foster decentralized and socially resilient innovation. The Copacabana Demo illustrates how generative AI can narrow the gap

between territorial knowledge and practical action, laying the groundwork for a replicable framework capable of scaling impact across neighborhoods and cities.

6. Conclusion

This project demonstrated how AI tools can serve as a means rather than an end, amplifying the potential of existing innovation frameworks and enabling new forms of civic protagonism. By re-signifying a widely known tool into an assistant for creativity and innovation, the Copacabana Demo provided change makers with practical guidance to act upon real community needs through feasible and impactful initiatives. The prototype brought urban interventions closer to everyday citizens, decentralizing a process that had long been concentrated in institutional domains.

The Copacabana case illustrates that embedding AI within participatory design frameworks can effectively bridge the gap between diagnosis and action. By coupling the Local Innovation Map with a culturally familiar interface, the project not only enhanced accessibility but also demonstrated the possibility of scalable, citizen-centered smart cities. In this sense, the study directly addressed its guiding question: How can AI be brought closer to the citizens to enable transformative territorial action?

Moving beyond TRL5, the evolution of AI Copacabana reveals two possible complementary directions. The first involves enhancing usability and user experience, refining the assistant to better support citizen-users in structuring and implementing local initiatives. The second, as an alternative research path, envisions advancing the Local Innovation Map into a social digital twin—a dynamic, data-driven representation of local social systems grounded in residents' perceptions and priorities. Unlike conventional digital twins focused on infrastructure, this model would simulate scenarios of social innovation and community-led interventions, offering policymakers, civil society, and citizens a safe environment to anticipate outcomes and test strategies before implementation.

Together, these trajectories could consolidate the role of generative AI as both a practical tool for immediate citizen engagement and a frontier for anticipatory governance, strengthening the foundations of participatory, decentralized, sustainable, and citizen-driven urban transformation.

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