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ADVANCING UNDERGROUND URBAN SPACE PLANNING: THE POTENTIAL OF FORESIGHT METHODS IN SYSTEMIC PLANNING AND TRANSITION MANAGEMENT

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Abstract: Underground urban spaces (UUS) are becoming a crucial resource in modern cities due to the increasing limitations of surface space, necessitating the application of specific foresight methods that integrate urban planning, infrastructural, environmental, and technological factors. The historical development of UUS planning represents a dynamic process marked by alternating periods of innovation and stagnation, with the past decade witnessing a slowdown in the development of new approaches. This stagnation is reflected in the frequent repetition of existing guidelines, recommendations, and conclusions, while institutional frameworks demonstrate a limited capacity to absorb new concepts. Within contemporary theoretical and methodological frameworks, the systemic approach to urban underground spaces and Transition Management for UUS emerges as potentially transformative factors in overcoming these challenges. These approaches define the frameworks for the application of foresight methods, provide tools for improving the management process, and enable the inclusion of all relevant stakeholders in decision-making processes, relying on a multidisciplinary and integrated approach. This raises the question: Which foresight methods provide the most adequate results in the context of systemic approaches and Transition Management in UUS planning? In the context of the increasing application of foresight methods in urban planning, this paper conducts a comparative analysis of different foresight methods through theoretical comparisons of potential transformative factors to determine which methods are most suitable for anticipating the future use of underground urban spaces, taking into account the principles of the systemic approach and Transition Management. The study identifies methodological frameworks that can contribute to the development of new UUS utilization models, capable of overcoming social barriers, fostering the integration of all interested parties, and improving the strategic planning process. The aim of this research is to highlight the additional potential of foresight methods in creating sustainable solutions and fostering innovative urban planning practices in the domain of underground urban spaces. Furthermore, the study analyzes key challenges in the implementation of these methods, identifies possible guidelines for selecting the most reliable foresight methods concerning specific urban planning challenges, and proposes directions for future research and strategic development in this field. The research aims to enhance interdisciplinary dialogue among urban planners, engineers, policymakers, and the wider public, ensuring a holistic, innovative, and sustainable approach to underground urban space planning.

Keywords: Foresight Methods, Underground Urban Spaces, Systemic Approach, Transition Management

1. INTRODUCTION

In the context of rapid urbanization and limited surface space, underground urban spaces (UUS) are emerging as a key resource for the sustainable development of future cities. Traditional planning approaches, focused primarily on surface-level interventions, have proven insufficient to address complex challenges such as traffic congestion, pollution, and land scarcity. UUS are increasingly taking on multifunctional roles; however, their effective utilization is hindered by fragmented planning, sectoral isolation, and inadequate institutional frameworks (Admiraal and Cornaro, 2016). Contemporary challenges call for integrated, three-dimensional planning that synchronizes above-ground and underground functions, along with anticipatory methods such as foresight approaches. This paper explores how foresight tools and methods can contribute to systemic planning

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and transition management in the development of UUS, offering strategic recommendations for urban planners, policymakers, and researchers to foster more resilient and sustainable cities (Delmastro et al, 2016).

Planning underground urban spaces represents a complex socio-technical challenge requiring interdisciplinarity, long-term strategic thinking, and adaptive governance approaches. To overcome fragmentation and inefficiency in current practices, this study is grounded in three interrelated theoretical pillars: systems planning, transition management, and foresight methodologies. Systems planning enables a holistic understanding of UUS as adaptive systems whose components—ranging from geology and infrastructure to social and regulatory factors—interact dynamically. Rather than pursuing isolated solutions, this approach emphasizes functional integration and conflict anticipation through tools such as 3D GIS modeling and multidisciplinary analyses (v. d. Tann et al.,2020; Bobylev, 2009).

Transition management offers a process-oriented framework for guiding long-term change through participation, experimentation, and social learning, while foresight methods (such as scenario planning, backcasting, Delphi, etc.) support anticipation of uncertain futures and the formulation of desirable development pathways (Slaughter, 1993; Lambert et al., 2024). Together, these concepts enable the design of flexible and inclusive strategies suited to the complexity of UUS, while reinforcing institutional coordination and stakeholder engagement. By integrating these approaches, the paper proposes a theoretical framework for sustainable and anticipatory governance of subsurface resources, aligned with global objectives for urban resilience and sustainability.

2. METHODOLOGICAL VISION

The methodology of this research is based on an integrative theoretical framework that combines foresight methods, transition management (TM), and systemic planning, with the aim of enhancing future-oriented planning and governance of Urban Underground Spaces (UUS). Building upon existing literature (Slaughter, 1993; v. d. Tann et al.,2020; Debrock and Coppens, 2023), the approach comprises three core process phases: (1) system analysis and mapping, (2) visioning and scenario development using foresight tools, and (3) development and implementation of transition strategies. A particular emphasis is placed on the social implications of these processes, recognizing the importance of ethics, inclusivity, and participation, as the challenges of UUS planning often lie less in technical limitations and more in the lack of social legitimacy and coordination among stakeholders.

While technology is indispensable, the research acknowledges that its advancement often surpasses the capacity of social and institutional systems to apply it responsibly (Admiraal and Cornaro, 2020). Therefore, special attention is given to social foresight and collective responsibility, in line with the principles of critical futures thinking [9], to encourage more just, sustainable, and long-term legitimate strategies for UUS. The proposed methodological framework rests on participatory and iterative learning processes, enabling the integration of social values across all phases of planning and implementation.

2.1. System Analysis and Mapping

This process entails a holistic understanding of the urban underground as a complex adaptive system, as defined by von der Tann et al. (v. d. Tann et al.,2020). Key steps include:

- **System element identification**: Mapping geological, infrastructural, regulatory, and social components of UUS, and defining functional, territorial, and institutional boundaries (v. d. Tann et al.,2020).
- **Interdependency analysis**: Applying systems thinking to explore interactions between underground functions (e.g., metro systems, utility networks, groundwater) and their impacts on aboveground systems.
- **Data collection**: Using GIS tools and 3D geological models to integrate data on geology, infrastructure, and property, enabling spatial and sectoral integration (Delmastro et al, 2016).
- **Stakeholder involvement**: Establishing interdisciplinary teams (engineers, urban planners, ecologists, citizens) to identify priorities and potential conflicts, in accordance with Slaughter's emphasis on participation (Riedy, 2021).

2.2. Visioning and Scenario Development through Foresight Methods

The application of foresight methods facilitates the anticipation of future needs and challenges by generating multiple scenarios for UUS use. This process builds on Slaughter's integrative approach (Slaughter, 1993; Riedy, 2021). and the concept of "futures empathy" (Lambert et al., 2024). The process includes, but is not limited to, the following foresight methods:

- **Scenario planning**: Developing alternative futures (e.g., underground cities as transport hubs, green zones, or shelters) based on key uncertainties such as climate change, demographic pressures, and technological innovation (Sliuzas et. al., 2015).
- **Backcasting**: Defining desirable futures (e.g., sustainable, multifunctional UUS) and mapping backward from these goals to identify steps for realization, considering legal and institutional constraints (Debrock and Coppens, 2023).
- **Delphi method**: Structured expert and stakeholder consultation to build consensus on priorities and strategies for UUS (Slaughter, 1993).
- **Causal Layered Analysis (CLA)**: Exploring deeper layers of meaning, including social values, worldviews, and myths shaping the perception of underground space, to promote ethical and inclusive visions (Riedy, 2021).
- **Future Design**: A method that fosters "futures empathy" by having participants imagine themselves as future generations, enhancing sensitivity to long-term societal and environmental needs (Lambert et al., 2024).
- **Fuzzy Cognitive Maps (FCM)**: Constructing graphical models that represent causal relationships between key UUS factors (e.g., infrastructure, ecology, social acceptability), with fuzzy weights ranging from -1 to 1, enabling scenario simulations and identification of leverage points under uncertainty (Jetter and Kok, 2014).

2.3. Development and implementation of transition strategies

The integration of transition management (TM) principles and practices ensures that visions and scenarios are translated into actionable strategies. Key elements include:

- **Transition arena**: Establishing a platform for collaboration among pioneers (e.g., innovators in underground architecture), urban planners, regulators, and citizens to co-develop a shared vision and strategy (Debrock and Coppens, 2023).
- **Transition agenda**: Setting long-term goals and intermediate milestones for the transformation of UUS, including legal reforms, institutional coordination, and pilot projects (Voß et. al.,2009).
- **Experimental niches**: Launching pilot initiatives (e.g., smart underground hubs, green subterranean zones) to test innovations and enable learning-by-doing (Debrock and Coppens, 2023).
- **Monitoring and evaluation**: Continuously tracking and adjusting strategies based on feedback, using indicators of resilience, inclusivity, and sustainability (v. d. Tann et al.,2020).

Social participation: Empowering communities through workshops and public consultations, thereby promoting collective responsibility, in line with Slaughter's concept of social foresight (Riedy, 2021).

3. APPLICATIONS AND CONTRIBUTIONS OF FORESIGHT METHODS TO SYSTEMIC PLANNING AND TRANSITION MANAGEMENT

This section, drawing on the social implications of Slaughter's critical futures thinking, summarizes the key foresight methods, their applications in systemic planning and transition management, and their contributions to both methodologies in the context of Urban Underground Spaces (UUS). The presented tables are structured according to Slaughter's layers of futures work (pragmatic, critical, epistemological), in order to highlight their integrative potential.[3]

Table 1. *Pragmatic Level*

Method	Social implications (Slaughter)	Application in systemic planning of Urban Underground Spaces (UUS)	Contribution to systemic planning	Application in transition management (TM)	Contribution to transition management
Scenario planning	It promotes social resilience by exploring multiple futures, enabling communities to prepare for uncertainty (Riedy, 2021).	Scenario development for UUS (e.g., underground transport, green zones, shelters) to anticipate climate and demographic challenges (Sliuzas et. al., 2015).	Enables the identification of key uncertainties and interactions between underground and surface systems, supporting spatial and sectoral integration (v. d. Tann et al.,2020).	Developing diverse scenarios for UUS within the transition arena, enabling pioneers and stakeholders to identify strategic pathways (Debrock and Coppens, 2023).	Supports the development of a transition agenda by identifying alternative pathways and strategies for the transformation of UUS (Debrock and Coppens, 2023).
Delphi method	Fosters collective responsibility by incorporating expert and societal perspectives, ensuring consensus on priorities (Slaughter, 1993).	Consultation with experts and citizens on UUS priorities (e.g., safety, ecology, accessibility) (Debrock and Coppens, 2023).	Enhances coordination among stakeholders and reduces sectoral conflicts, contributing to process integration (v. d. Tann et al.,2020).	Structured engagement of experts and stakeholders within the transition arena to define shared goals and strategies for UUS (Voß et. al.,2009).	Facilitates the formation of a transition arena, enabling interdisciplinary collaboration and consensus on shared goals (Voß et. al.,2009).
GIS and 3D modeling	Increases transparency and accessibility of information, enabling communities to gain insight into the planning process (Sliuzas et. al., 2015).	Visualization of underground resources and infrastructure to improve spatial and resource management (Delmastro et al, 2016).	Supports data integration and spatial analysis, enabling precise mapping of interdependencies (Bobylev, 2009).	Use of GIS tools in pilot projects and experimental niches to test innovations under real-world UUS conditions (Debrock and Coppens, 2023).	Provides a technical foundation for experimental niches, enabling the testing of innovations in real-world conditions (Debrock and Coppens, 2023).
Fuzzy Cognitive Maps (FCM)	Encourages participation and collective responsibility through co-creation of models, enabling the integration of subjective	Development of FCM models to map causal relationships between UUS factors (e.g., infrastructure, costs, social acceptability) and	Enables the modeling of complex interdependencies and uncertainties, supporting systemic integration and risk anticipation (v. d. Tann et al.,2020).	Use of FCM within the transition arena to identify key intervention points and simulate policy impacts on UUS	Enables reflexive governance through the simulation of systemic effects and identification of strategic levers for transition (Debrock and Coppens, 2023).

[3] Slaughter's layers of futures work—pragmatic, critical, and epistemological—provide an integrative framework for exploring futures in complex systems such as urban planning (Riedy, 2021). The *pragmatic level* focuses on practical, short-term aspects, using scenario analysis and the Delphi method to address challenges such as UUS infrastructure planning. The *critical level* investigates underlying social and value assumptions, employing Causal Layered Analysis (CLA) to deconstruct dominant narratives and promote equity in the use of UUS. The *epistemological level* reflects on knowledge systems and worldviews, applying Future Design to develop long-term, ethically grounded strategies that consider the interests of future generations. The integration of these levels balances practical and societal dimensions, enhancing both the sustainability and fairness of UUS planning (Slaughter, 1993; Riedy, 2021).

	perspectives and uncertainties (Jetter and Kok, 2014).	simulate "what-if" scenarios (Jetter and Kok, 2014).		(Jetter and Kok, 2014).	

Table 2. *Critical Level – Social Implications, Applications, and Contributions*

Method	Social implications (Slaughter)	Application in systemic planning of Urban Underground Spaces (UUS)	Contribution to systemic planning	Application in transition management (TM)	Contribution to transition management
Causal Layered Analysis (CLA)	Reveals hidden values and power structures, promoting ethical and inclusive visions of the future (Riedy, 2021).	Analysis of social narratives about UUS (e.g., "the underground as a technical layer" vs. "a multifunctional resource") to reshape planning approaches (Al-shanty,2019).	Enables the reconsideration of sectoral assumptions and the promotion of inclusive strategies, contributing to conceptual integration (v. d. Tann et al.,2020).	Use of CLA within the transition arena to reassess normative goals and values in UUS planning (Voß et. al.,2009).	Fosters reflexivity in transition processes, enabling the reassessment of normative goals and values (Voß et. al.,2009).
Normative foresight	Encourages the creation of desirable futures based on equity and sustainability, empowering communities (Slaughter, 1993).	Defining visions for UUS that prioritize social justice and ecological sustainability (e.g., underground public spaces) (Lambert et al., 2024).	Supports the development of long-term goals that align social and environmental priorities, enhancing process integration (Debrock and Coppens, 2023).	Formulation of normative visions within the transition agenda to guide change toward sustainable UUS practices (Debrock and Coppens, 2023).	Provides a foundation for the transition agenda, guiding change toward desirable and ethical outcomes (Debrock and Coppens, 2023).
Participatory workshops.	Strengthens social cohesion and collective responsibility by involving communities in decision-making processes (Riedy, 2021).	Organizing workshops with citizens and experts for UUS design, with a focus on inclusivity (Sliuzas et. al., 2015).	Increases the legitimacy and social acceptability of plans, contributing to institutional coordination (Voß et. al.,2009).	Engaging communities within the transition arena to co-develop shared visions and pilot projects (Debrock and Coppens, 2023).	Empowers the transition arena by enabling broad participation and social learning (Debrock and Coppens, 2023).

Table 3. Epistemological Level – Social Implications, Applications, and Contributions

Method	Social implications (Slaughter)	Application in systemic planning of Urban Underground Spaces (UUS)	Contribution to systemic planning	Application in transition management (TM)	Contribution to transition management
Future Design	Promotes "futures empathy," enabling an understanding of the needs of future generations and fostering	Envisioning UUS from the perspective of future generations (e.g., 2050) to develop sustainable	Encourages long-term thinking and ethical responsibility, enhancing both conceptual and process integration	Use of "futures empathy" within the transition arena to develop visions that consider the interests of future	Supports the development of long-term visions and experimental niches, focusing on sustainability and future

	long-term responsibility (Lambert et al., 2024).	strategies (Lambert et al., 2024).	(v. d. Tann et al.,2020).	generations (Lambert et al., 2024).	generations (Debrock and Coppens, 2023).
Systems thinking	Enables the understanding of complex social and cultural dynamics, supporting holistic strategies (Riedy, 2021).	Analysis of UUS as part of a broader urban system, taking into account ecological, social, and technical interactions (v. d. Tann et al.,2020).	Enables holistic management of interdependencies, contributing to sectoral and spatial integration (Bobylev, 2009).	Applied within the transition agenda to understand the complexity of UUS and to guide change through reflexive processes (Voß et. al.,2009).	Provides a framework for reflexive governance, enabling the adaptation of strategies within complex systems (Voß et. al.,2009).
Backcasting	Promotes social responsibility by focusing on desirable futures and the strategic steps needed to achieve them (Slaughter, 1993).	Defining ideal states for UUS (e.g., multifunctional underground cities) and mapping the steps for implementation (Debrock and Coppens, 2023).	Supports the development of transition strategies and long-term plans, enhancing process integration (Voß et. al.,2009).	Use of backcasting to define intermediate steps within the transition agenda, guiding pilot projects toward sustainable outcomes (Debrock and Coppens, 2023).	Enables a structured process for achieving long-term goals by defining intermediate steps and pilot projects (Debrock and Coppens, 2023).

Note: Some foresight methods, such as backcasting, systems thinking, and Fuzzy Cognitive Maps (FCM), can be applied across multiple levels—pragmatic, critical, and epistemological. However, in the table, they are presented under the level where they are most adaptable and effective, based on their relevance and efficiency in specific UUS planning contexts.

4. EVALUATION AND ITERATIVE LEARNING

To ensure the reliability, credibility, and social relevance of strategies for Urban Underground Space (UUS) planning, it is essential to carry out evaluation and enable iterative learning after the foresight process. This process should integrate quantitative, qualitative, and ethical approaches, supported by advanced digital technologies (Zhu et. al., 2016). The evaluation is based on the principles of a systemic framework, providing a structured and transparent approach to assessing the validity, utility, and ethical grounding of proposed strategies (Piirainen, et. al., 2012). Particular attention is given to participatory and ethical dimensions, in line with the tradition of critical futures thinking advocated by Slaughter and further developed by (Riedy,2021).

Furthermore, bibliometric analyses (Ko and Yang, 2024) contribute to understanding broader trends and identifying gaps in existing research, which further enhances the reflexive potential of the strategies. This type of comprehensive evaluation framework not only increases the credibility and practical value of planning interventions but also promotes social learning and adaptation to the complex challenges of Urban Underground Spaces (UUS), thereby ensuring fairness and long-term sustainability. Evaluation is carried out as an iterative process across three interrelated levels - functional (usefulness and implementation), technical (feasibility and accuracy), and ethical (fairness and inclusivity) - employing combined methods and digital technologies to enable precise and multidimensional analysis.

Table 4. *Elements of Evaluation and Iterative Learning for UUS.*

Evaluation element	Methods and tools	Application in the context of UUS	References
Quantitative indicators	Measurement of metrics (e.g., reduction of CO_2 emissions, accessibility of public spaces, reduction of geological risks). Use of 3D GIS and digital layering. Multi-level grey approach and fuzzy synthesis evaluation methods. Software: SPSS, R, GIS tools.	Assessment of the impact depth of underground structures (e.g., metro lines) and their ecological consequences. Quantitative analysis of geological and urban planning data for the categorization of underground space suitability (Level I–IV).	von der Tann et al. (2020), Zhu et al. (2016)
Qualitative analyses	Causal Layered Analysis (CLA) for narratives. Critical Systems Heuristics (CSH) by Werner Ulrich. Interviews, workshops, focus groups. Tools: NVivo, evaluation matrices.	Analysis of social and cultural narratives about UUS (e.g., “the underground as a technical layer” vs. “a multifunctional resource”). CSH questionnaire for assessing stakeholder inclusion (citizens, urban planners, regulators) and ethical implications.	Riedy (2023), Piirainen et al. (2012)
Statistical methods and bibliometric analyses	Data analysis (SPSS, R). Silhouette coefficients for cluster validation. Latent Dirichlet Allocation (LDA) for topic modeling. Tools: VOSviewer, Python libraries for NLP.	Measuring changes in participants’ perceptions of “futures empathy.” Identifying thematic gaps in UUS research (e.g., lack of social aspects compared to technical ones).	Lambert et al. (2024), Ko and Yang (2024)
Iterative processes	Continuous evaluation (a priori, during the process, and a posteriori). Expert reviews, feedback loops. 3D visualization and virtual reality. Tools: Trello, Confluence, simulation software.	Regular workshops and data analysis to adapt UUS strategies. Simulation of different scenarios (e.g., underground transport hubs) to test resilience and alignment with objectives.	Voß et al. (2009), Piirainen et al. (2012), Zhu et al. (2016), Ko and Yang (2024)
Participatory evaluation	Workshops, focus groups, surveys. Evaluation matrices for goal alignment. Tools: Zoom, Microsoft Teams, questionnaires (e.g., Likert scales).	Assessing participant satisfaction and trust in UUS strategies. Involving citizens and experts to evaluate the usefulness and inspirational value of outcomes (e.g., plans for underground public spaces).	Piirainen et al. (2012), Riedy (2021)
Ethical reflection	CSH questionnaire for assessing motivation, power, knowledge, and legitimacy. Stakeholder discussions. Tools: Miro, MURAL, Google Docs for documentation.	Identifying power dynamics in UUS planning. Ensuring the inclusion of marginalized groups and the interests of future generations through “futures empathy.”	Piirainen et al. (2012), Lambert et al. (2024), Riedy (2021)

5. BRIEF DISCUSSION

The integration of foresight methods into Urban Underground Space (UUS) planning represents a transformative approach that enhances systemic planning (v. d. Tann et al.,2020) and transition management (Voß et. al.,2009; Debrock and Coppens, 2023), enabling the anticipation of future challenges, the engagement of diverse stakeholders, and the development of sustainable strategies within complex urban systems. Unlike traditional approaches, which are often reactive and linear (Shin, 2013; Wiranegara, 2017), foresight methods such as scenario planning, backcasting, Delphi, and Causal Layered Analysis (CLA) (Slaughter, 1993; Inayatullah, 2011; Quista and Vergragt, 2006) allow for the creation of alternative futures and the structuring of strategic thinking.
Their value lies in the ability to connect technical expertise with societal values, fostering inclusivity, ethical responsibility, and long-term resilience (Lambert et al., 2024; Tonn, 2003). Foresight also contributes to enhancing the social legitimacy of planning efforts through participatory processes (Renn, 2022; Pace, 2025), while flexible methods such as backcasting and scenario planning enable the adaptation of strategies under conditions of uncertainty (Sliuzas et. al., 2015; Oliveira et. al., 2018).
However, their application faces numerous challenges. Implementation complexity, resource demands, lack of reliable data, and institutional fragmentation hinder the widespread adoption of foresight approaches (Mahmud, 2011; Admiraal and Cornaro, 2016; Wang et. al., 2013). Cognitive biases and actors' limited temporal perspectives further reduce anticipatory effectiveness (Faiella and G. E. Corazza, 2025; Lalot et. al., 2019), while institutional and cultural barriers—such as short-term political focus and resistance to change—require systemic reforms and increased awareness (Tonn, 2003; MacDonald, 2012; Zegras and L. Rayle, 2012).
Additionally, the lack of standardization within foresight practice complicates comparative evaluation and institutionalization of methods (Roya et. al., 2016; Deng et. al., 2023), raising the question of whether a method that inherently demands contextual flexibility can or should be standardized (Krawczyk and Slaughter, 2010).
In the context of systemic planning, foresight enables the integration of geological, infrastructural, ecological, and social aspects into a unified planning framework (Bobylev, 2009; Vähäaho, 2016; Dufvaa and Ahlqvist, 2015). At the same time, within the domain of transition management, foresight contributes to the formation of visions and strategies through participatory and deliberative processes (Debrock and Coppens, 2023; Zhang and Li, 2018; Rijkens–Klompa et. al.,2017).
Furthermore, metamodern and human-centered approaches (Fergnani and B. Cooper, 2023; Slaughter, 2002; Daffara, 2011) introduce ethical and cultural dimensions into foresight methods, promoting the concept of a "culture of anticipation" (Slaughter, 2002) and the integration of underground spaces into visions of collective intelligence, solidarity, and sustainability. Models such as UPUS (Wang et. al., 2023) and Futures Consciousness (Lalot et. al., 2019) further illuminate the psychological and perceptual aspects of planning, while also pointing to the limitations of existing approaches in addressing cultural complexity and inclusivity.
In conclusion, foresight methods constitute a vital resource for UUS planning, but their effective application depends on integration with systemic approaches, institutional support, and the development of methodological frameworks that balance technical precision with social responsibility and cultural reflexivity.

6. CONCLUSION

Foresight methods represent a crucial potential for transforming the planning of Urban Underground Spaces (UUS), particularly through their integration with systemic planning (v. d. Tann et al.,2020) and transition management (Voß et. al.,2009; Debrock and Coppens, 2023). They enable the anticipation of long-term challenges, the development of alternative visions, and the creation of flexible strategies within the context of complexity, uncertainty, and the imperative for sustainability. Compared to traditional approaches, foresight methods achieve greater anticipatory capacity, a higher degree of social inclusivity, and stronger orientation toward sustainability (Slaughter, 1993; Lambert et.al., 2024).
Their strength lies in the combination of technical precision and social responsibility, as well as in fostering participatory processes and collective learning. Through methods such as scenario planning, backcasting, CLA, and the Delphi technique, foresight facilitates a deeper understanding of possible futures and the proactive shaping of desirable development pathways. However, their implementation requires overcoming several challenges, including data scarcity, institutional barriers, cognitive biases, and the lack of methodological standardization (Mahmud, 2011; Faiella and Corazza, 2025; Krawczyk and Slaughter, 2010).
To enhance the practical applicability of foresight methods, their operationalization through locally adapted protocols and guidelines is essential, supported by digital tools such as 3D GIS, AHP-cloud models, and simulation platforms (Deng et. al., 2023). In addition, strong institutional support is needed to integrate foresight approaches into legal, planning, and strategic documents (Admiraal and Cornaro, 2016), along with the development of appropriate indicators for monitoring the resilience and sustainability of UUS (Roya et. al, 2015; Ko and Yang).

In conclusion, integrating foresight methods into UUS planning should not be viewed as an option but as an imperative for building more resilient, inclusive, and sustainable cities of the future. Their application must be supported through interdisciplinary collaboration, institutional reform, and broad stakeholder education to ensure that urban planning can adequately respond to 21st-century challenges in alignment with the Sustainable Development Goals (SDGs).

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