



How serious games can drive sustainable urban planning and city transformation

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The potential of co-created serious games to support cross-sectoral municipal planning for sustainability transformations

Rapid biodiversity loss, combined with climate change and urban densification, requires different sectors of cities to work together to support **sustainability transformations**. In this **policy handbook**, the Transformative Cities team examines **the potential of serious games**—games where the primary purpose is not entertainment—to support cross-sectoral planning in areas such as fossil-free transport, biodiversity conservation, climate mitigation and adaptation, and improving human well-being in cities in **Finland** and **Europe**. These games can take various forms, ranging from single-user online games to board games and multiplayer role-playing games.

We examine how and to what extent these games can assist policymakers in **identifying** and **unlocking** planning trade-offs for sustainability transformations, and then outline policy implications of applying a serious game in the city of **Lahti, Finland** (see Fig. 1). By policymakers, we refer to the municipal politicians and authorities.

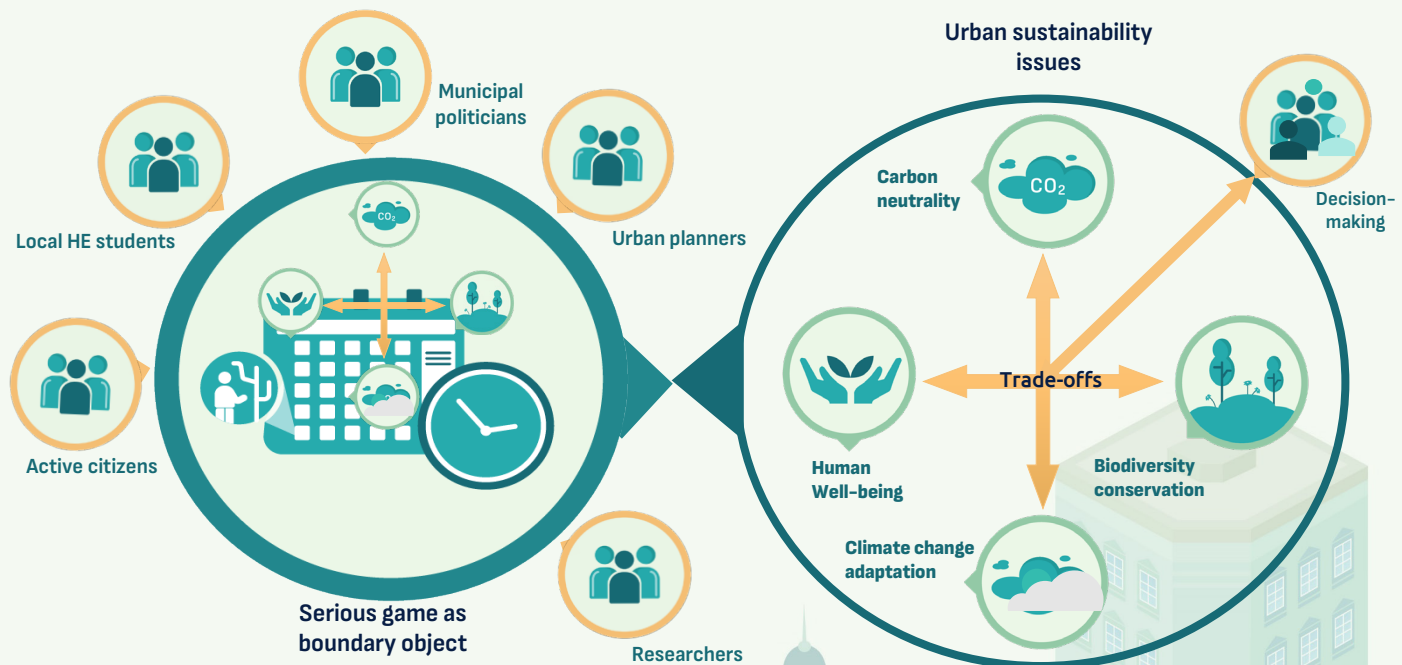


Figure 1. The Transformative Cities serious game serves as a boundary object for various stakeholders, helping to build a common understanding of the multiple sustainability challenges, targets, and complex decision-making situations in a city.



Identifying trade-offs in urban sustainability through serious games

Serious games for urban planning support can be used to **co-produce knowledge** with various stakeholders and planners, enhance learning on complex issues for a specific group, such as citizens or policymakers, and facilitate **constructive negotiations** on sensitive and complex issues between different stakeholders (see Table 1).

Trade-offs are situations where a gain in one area creates a loss in another. In urban sustainability policy, trade-offs pose **challenges** to decision-making. For example, trade-offs may arise between urban growth and biodiversity goals when natural areas are converted into residential zones. Another instance is the choice between stormwater management options, where natural solutions that support biodiversity may be less effective than more expensive grey infrastructure. The IPCC (2022) recommends **negotiating trade-offs** among diverse actors and considering distributive justice in the implementation of **climate policy**.

Considering trade-offs is reported to offer numerous benefits for decision-making. In complex situations where win-win and no-regret solutions are limited, it helps evaluate **additional alternatives**. Identifying trade-offs can also reveal key drivers and barriers to desired outcomes, allowing for the maximization of benefits and the minimization of negative impacts in advance.

Serious games provide a methodological foundation for expert and stakeholder discussions on the future-oriented urban interventions and transformative changes, helping to explore decision-making on trade-offs in urban policy areas such as climate, biodiversity, and well-being.

Table 1. Different functions of serious games support urban planning in addressing sustainability transformation.

Functions of serious games	Examples of how serious games address sustainability trade-offs and support urban planning
Cross-sectoral problem solving	•Facilitating new collaboration opportunities and communication across sectors (Bathke et al, 2019)
Identification and sense-making of perceptions	•Identification of levers of urban neighbourhood transformation (Schoor et al, 2024)
Education	•Improving residents' awareness of landscape-scale challenges (Fox et al., 2022); enhancing citizens' understanding of smart-city systems and behaviour change (Cavada & Rogers, 2023); educating stakeholders on complex strategic sustainability policy decision-making (Ghodsvalli et al, 2022)
Conflict resolution	•Dealing with conflict between diverse stakeholders by testing alternative scenarios of urban planning (Imottesjo & Kain, 2018)
Discussion facilitation	•Enhancing communication between stakeholders that would usually not meet one another (Edwards et al, 2019) •The game structure can increase accessibility of discussion for diverse levels of background knowledge (Abad et al, 2020) •Realistic game visualizations foster discussion on the aesthetics of urban areas (Schalbetter et al, 2023)
Empowering communities and engaging stakeholders	•Fostering connections to other stakeholders and capacity to engage (Edwards et al, 2019) •Improved community engagement in green space planning through gamifying (Fox et al, 2022)
Innovation and learning space	•Social learning for finding solutions for climate change adaptation (Flood et al, 2018) •Co-creating knowledge to tackle complex problems (Wibeck & Neset, 2020)



Using a serious game to support the implementation of an ongoing policy strategy

Lahti, located in **Southern Finland**, has a population of 121 000 people, making it the 9th largest city in the country by population. Strategically positioned at the intersection of major transit routes, it serves as a **vital link** between the south and north, as well as the east and west. The city is just 100 km from the capital, Helsinki, and is well-connected to the metropolitan area by local commuter trains. Known for its pioneering environmental initiatives, Lahti was **the European Green Capital in 2021**. In October 2024, it set an ambitious target of achieving nature positivity by 2030 and is on track to become Finland's **first carbon-neutral city** by 2027.

In the Transformative Cities project, an **urban planning game** was co-created with the urban planners of Lahti in 2023 and 2024. The game platform features a 3D map of the city's centre, produced by SOVA3D (see Fig. 2).

The aim of the game is to achieve the Lahti city centre vision 2040, promote active mobility in the case area and to gain enough points to each of four targets: climate change adaptation, biodiversity, citizen well-being and climate change mitigation. The game **was played by local decision-makers, higher education students and active citizens**. In each game session, 3–5 players worked as a group toward the shared goal by selecting different **urban planning measures** – progressing from 2025 in five-year decision-periods. With a limited total budget, players were forced to **navigate trade-offs** in achieving these targets within the constraints of the available space and time.

The co-creation process began during the project planning phase and continued through the planning, application, and analysis stages (see Table 1).

Policy and legal analysis served as key **background research** for developing the game's content. However, legislative restrictions or enabling factors were not relevant to the chosen policy process—the implementation of the Lahti Center Vision—and were therefore excluded from the game rules.

Despite this, the legal analysis revealed several contradictions and untapped opportunities that have hindered **Finnish cities' climate** and biodiversity policy implementation. Another game, designed as part of the Transformative Cities project in 2025 for the City of Helsinki, will explore how different actors respond to **alternative legal scenarios**, such as strict and quantitative climate, transportation, or biodiversity requirements in urban planning.



Table 2. Co-creation process of the Transformative Cities game in Lahti.

Co-creation phase	Participants
<ul style="list-style-type: none"> • Identification of the policy-relevant research problem in Lahti related to the urban sustainability transformation • Planning the research approach and research questions to address the problem 	<ul style="list-style-type: none"> • Lahti representatives in the consortium • Multidisciplinary research team of planning scientists, geographers, policy researchers, legal scholars, sustainability scholars
<ul style="list-style-type: none"> • Background research on sustainable urban mobility transformation barriers and enablers in Finland: <ul style="list-style-type: none"> – Policy and legal document analysis – 5 focus group discussions with planners from four cities – Literature review 	<ul style="list-style-type: none"> • Project research team on urban sustainability, urban policy & governance, urban planning, sustainable mobility transition legislation
<ul style="list-style-type: none"> • Contextual analysis of the Lahti case <ul style="list-style-type: none"> – Identification and analysis of relevant on-going policy processes: biodiversity, climate, and urban mobility policies of Lahti; Lahti Center visions strategy 	<ul style="list-style-type: none"> • Broadened Lahti planners' group: traffic, master plan, street plan, landscape planning, societal outreach • Project core research team: urban sustainability, urban policy & governance, urban planning
<ul style="list-style-type: none"> • Serious game development: <ul style="list-style-type: none"> – 4 co-creation workshops – Site-visit walk-and-talk – Two test game sessions 	<ul style="list-style-type: none"> • Broadened Lahti planners' group • Project core research team • Game platform developer SOVA3D
<ul style="list-style-type: none"> • Participant recruitment & game event arrangements • Analysis & recommendations 	<ul style="list-style-type: none"> • Broadened Lahti planners' group • Project core research team

The trade-offs most frequently discussed during the game sessions involved balancing well-being and biodiversity benefits. For instance, while increasing urban green infrastructure and biodiversity was considered important, concerns were raised about the tidiness of green spaces, potential health impacts, and security issues. The most commonly adopted strategy was to address multiple **sustainability targets** simultaneously, seeking co-beneficial solutions that balanced citizen well-being, biodiversity, and climate benefits. However, a trade-off of this approach was that measures highly effective for specific targets, but lacking synergies were rarely implemented.

Rich discussions and creative ideas for developing Lahti's urban centre emerged during the serious game sessions. Participants found the game effective in translating Lahti's sustainability targets into actionable concepts, highlighting the success of the thorough groundwork in identifying relevant actions based on literature and planners' expert knowledge.

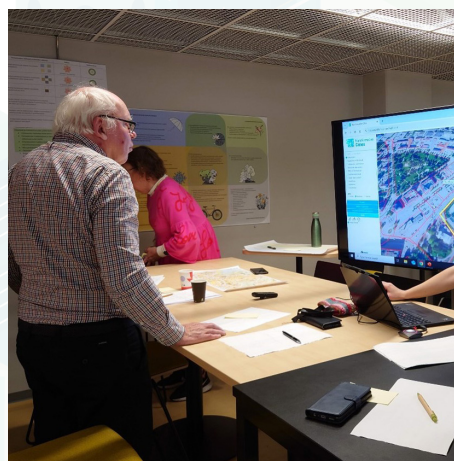


While urban strategies and visions are often abstract and high-level, the game helped participants better understand how these **goals could be achieved**, the level of effort required to **balance different needs and values**, and the **process of negotiating** which trade-offs to accept.

The game fostered a **sense of community** among players and provided an **inclusive platform** where everyone's opinions could be heard (see Fig. 3a & b). Participants appreciated how the game's logic encouraged **collaboration** and **consensus-building**. Regardless of each individual player having to make compromises, all participants were satisfied with the result of the game. However, it was noted that while the game reflects real-world challenges, the decisions made during gameplay often did not mirror real-life actions. This underscores the value of serious games in exploring **unconventional behaviour patterns** and testing **innovative approaches**.



Figure 2. The serious game platform and its focal area of interest (highlighted in yellow).



Figures 3a & b. The game session in Lahti.



Recommendations

Serious game results can point towards acceptable urban planning decisions

- The results of the Lahti game showed that share of bicycle and pedestrian mobility in the city centre can be increased by implementing green infrastructure that appeals to citizens, offering aesthetic value, shade, cooling, and spaces for activities such as playgrounds and sports.



A co-created serious game can serve as a platform to support urban planning for just sustainability transformations

- Citizens' and politicians' preferences on urban planning decisions are often diverse and conflicting, and finding a balanced compromise between these views may result in insufficient action toward sustainability targets. However, a platform for learning from these differing perspectives is essential for achieving a just urban transformation. This game can be used as such a platform.
- Co-creation of a serious game between the city, game platform planners, and researchers should be based on meaningful collaboration for everyone at the different stages of the game development to identify and address policy-relevant issues.
- Background work for the game content and rules development requires multi- and cross-disciplinary collaboration to create novel avenues for implementing and researching urban sustainability transformations



The serious game use in support of ongoing policy implementation can help to collect and learn from the perceptions and knowledge of different groups

- The game setting allows an interactive collection of stakeholders' perceptions on the trade-offs related to an ongoing urban planning process.
- The multiple views and knowledges of citizens' and politicians need to be translated and synthesized to usable place-based information for urban planners.
- Multiple data sets integration into the game platform could enhance the usability of the game for learning about and negotiating complex issues such as trade-offs in sustainability policy implementation.



An online game platform enhances the game's usability

- An online platform for the game enables its ongoing development as data availability, usability, and policy targets evolve. For instance, in Lahti, mobility data can be integrated to monitor the impact of changes in the future. A potential next step for the city could be to choose the most important and least contradictory changes and to make a plan to monitor the change in mobility changes.





References

Abad, J., Booth, L., Baills, A., Fleming, K., Leone, M., Schueller, L., & Petrovic, B. (2020). Assessing policy preferences amongst climate change adaptation and disaster risk reduction stakeholders using serious gaming. *International Journal of Disaster Risk Reduction*, 51. <https://doi.org/10.1016/j.ijdr.2020.101782>

Bathke, D. J., Haigh, T., Bernadt, T., Wall, N., Hill, H., & Carson, A. (2019). Using Serious Games to Facilitate Collaborative Water Management Planning Under Climate Extremes. *Journal of Contemporary Water Research & Education*, 167. <https://doi.org/10.1111/j.1936-704X.2019.03311.x>

Center vision 2040, Lahti. <https://www.lahti.fi/asuminen-ja-ymparisto/kaupunkiympariston-suunnittelu/uudistuva-lahti/keskustan-kehittaminen/keskustavisio/>

Canada, M. & Rogers, C.D., (2023). Serious gaming as a means of facilitating truly smart cities: a narrative review. In: *Smart Cities at Play: Technology and Emerging Forms of Playfulness*, pp.89–104. <https://doi.org/10.1201/9781003461043>

Edwards, P., Sharma-Wallace, L., Wreford, A., Holt, L., Cradock-Henry, N. A., Flood, S., & Velarde, S. J. (2019). Tools for adaptive governance for complex social-ecological systems: A review of role-playing-games as serious games at the community-policy interface. *Environmental Research Letters*, 14. <https://doi.org/10.1088/1748-9326/ab4036>

Flood, S., Cradock-Henry, N.A., Blackett, P. & Edwards, P., (2018). Adaptive and interactive climate futures: systematic review of ‘serious games’ for engagement and decision-making. *Environmental Research Letters*, 13. <https://doi.org/10.1088/1748-9326/aac1c6>

Fox, N., Campbell-Arvai, V., Lindquist, M., Berkel, D. V., & Serrano-Vergel, R. (2022). Gamifying Decision Support Systems to Promote Inclusive and Engaged Urban Resilience Planning. *Urban Planning*, 7. <https://doi.org/10.17645/up.v7i2.4987>

Ghodvali, M., Dane, G. & de Vries, B., (2022). An online serious game for decision-making on food-water-energy nexus policy. *Sustainable Cities and Society*, 87. <https://doi.org/10.1016/j.scs.2022.104220>

Imottesjo, H., & Kain, J.-H. (2018). The Urban CoBuilder – A mobile augmented reality tool for crowd-sourced simulation of emergent urban development patterns: Requirements, prototyping and assessment. *Computers, Environment and Urban Systems*, 71. <https://doi.org/10.1016/j.compenvurbsys.2018.05.003>

IPCC, 2022: *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegria, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp., doi:10.1017/9781009325844.

Schalbetter, L., Salliou, N., Sonderegger, R., & Grêt-Regamey, A. (2023). From board games to immersive urban imaginaries: Visualization fidelity's impact on stimulating discussions on urban transformation. *Computers, Environment and Urban Systems*, 104. <https://doi.org/10.1016/j.compenvurbsys.2023.102003>

Schuur, J.S., Switalski, M., Salliou, N. & Grêt-Regamey, A., (2024). Identifying levers of urban neighbourhood transformation using serious games. *npj Urban Sustainability*, 4. <https://doi.org/10.1038/s42949-023-00138-5>

Wibeck, V. & Neset, T.S., (2020). Focus groups and serious gaming in climate change communication research—A methodological review. *Wiley Interdisciplinary Reviews: Climate Change*, 11. <https://doi.org/10.1002/wcc.664>





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