

Technologies of Humility

Synthesis Essay on Sustainable Urban Development and Smart Cities

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Introduction: A Nordic initiative in the quest for sustainable urban development

This essay presents a reflective synthesis of the findings of the four research projects funded through the Nordic initiative on Sustainable Urban Development and Smart Cities between 2000 and 2024. Sustainable urban development is understood by this initiative to broadly address and solve the social, economic, and environmental challenges of cities by promoting quality of life, with the ultimate goal of making cities inclusive, safe, and resilient (UN Sustainable Development Goal 11).

The Nordic initiative is a collaborative effort between the Academy of Finland, the Swedish Research Council for Sustainable Development, the Swedish Research Council for Health, Working Life and Welfare, the Swedish Energy Agency, the Research Council of Norway, and NordForsk. The aim is to promote co-operation between knowledge communities in the Nordic countries in order to enhance opportunities and address challenges relating to sustainable urban development and smart cities. Within this general aim, the five key objectives of the initiative are:

1. **inclusive co-production**
2. **interdisciplinary approaches**
3. **Nordic added value**
4. **prospects and limitation of digital technologies**
5. **capacity building for early career researchers**

This synthesis essay discusses the advancements in urban planning processes through different projects and how they contribute to sustainable urban development. Instead of simply summarising each project mechanically, the emphasis is on the insights offered by their findings. These insights have broader relevance to the idea of co-production in sustainable urban development, rather than being specific to individual cases.

Three concepts to consider

The projects in the Nordic initiative emphasised *co-production* and integrating this principle into their methods and practices, albeit with varying definitions and extents. Despite the differing definitions, the fundamental concept remained consistent: to promote increased interaction among decision-makers, experts, and the public, leading to a more inclusive and democratic decision-making process and knowledge generation. In the context of smart city solutions for sustainable urban development, this essay refers to these enhanced forms of interaction as "*technologies of humility*".¹

The concept of "*technologies of humility*" implies a re-evaluation of how governance is approached in societal matters that involve decision-making and expert knowledge, such as urban planning. "*Technologies of humility*" is a call for better engagement between decision-makers, experts, and the public, in order to make the decision-making process and knowledge generation more democratic. This requires not only formal processes and mechanisms of participation, but also **an ethos of public engagement that allows citizens, in a broad sense, to contribute their knowledge and skills in addressing common problems as active and imaginative agents**. This concept aligns with the idea of co-production that is central to the Nordic initiative and the projects that have been analysed.

Another notion related to the focus of the initiative is *equality*. **Rising inequalities present pressing challenges for our cities and communities and create serious obstacles to the creation of socially sustainable urban futures**. We define socially sustainable cities as cities that ensure equal access to the benefits of urban life for all, and we can see this theme running through all the projects with different empirical cases.²

1 Jasanoff, S. (2003) "Technologies of humility: citizen participation in governing science", *Minerva* 41: 223-44.

2 Dempsey, N., et al. (2011) "The social dimension of sustainable development: defining urban social sustainability", *Sustainable Development* 19(5): 289-300; Polèse, M. and Stren, R. eds (2000) *The Social Sustainability of Cities: Diversity and the Management of Change* (University of Toronto Press).

Defining a smart city

The concept of *smart city* has multiple definitions and is operationalised differently in different contexts. In their review of the concept, for example, Collins et al (2021, CAPS project) identify three areas that characterise a smart city: *social smartness*, *technological smartness*, and *environmental smartness*. According to them, social smartness has a focus on the quality of life, civic engagement, and well-being. Technological smartness is centred on flexible technology that is well utilised and strategically applied. Environmental smartness is focused on optimisation, waste management, and sustainable thinking.³ Another interpretation of the concept emphasises making urban networks and services more efficient through digital and telecommunication technologies for the benefit of inhabitants and local development. This implies a more interactive and responsive city administration to enable novel solutions for meeting the demands of sustainable futures. This interpretation emphasises the uniqueness of each context that shapes both the challenges and opportunities for cities and municipalities in their quest to find smart alternatives.⁴

These interpretations resonate with the aims of the Nordic initiative, which sees smartness as being more than technological solutions in the infrastructure of a city. **Smart solutions are at all levels of knowledge and technology; they are found in the physical structures, urban services, and innovative administrative solutions.** The four selected projects thus introduce smart and sustainable innovations that are accessible to different types of cities and diverse social groups.

3 Collins D. et al. (2021) "Brought by degrees: a focus on the current indicators of lean 'smartness' in smart cities", in Alarcón. *Lean Construction in Crisis Times: Responding to the Post Pandemic AEC Industry Challenges*, Fondo Editorial de la Pontificia Universidad Católica del Perú (PUCP) pp. 167-176.

4 Sandra Oliveira e Costa and Diana Huynh (2020). Nordgreen: Smart planning for healthy and green Nordic cities. Conceptual overview.

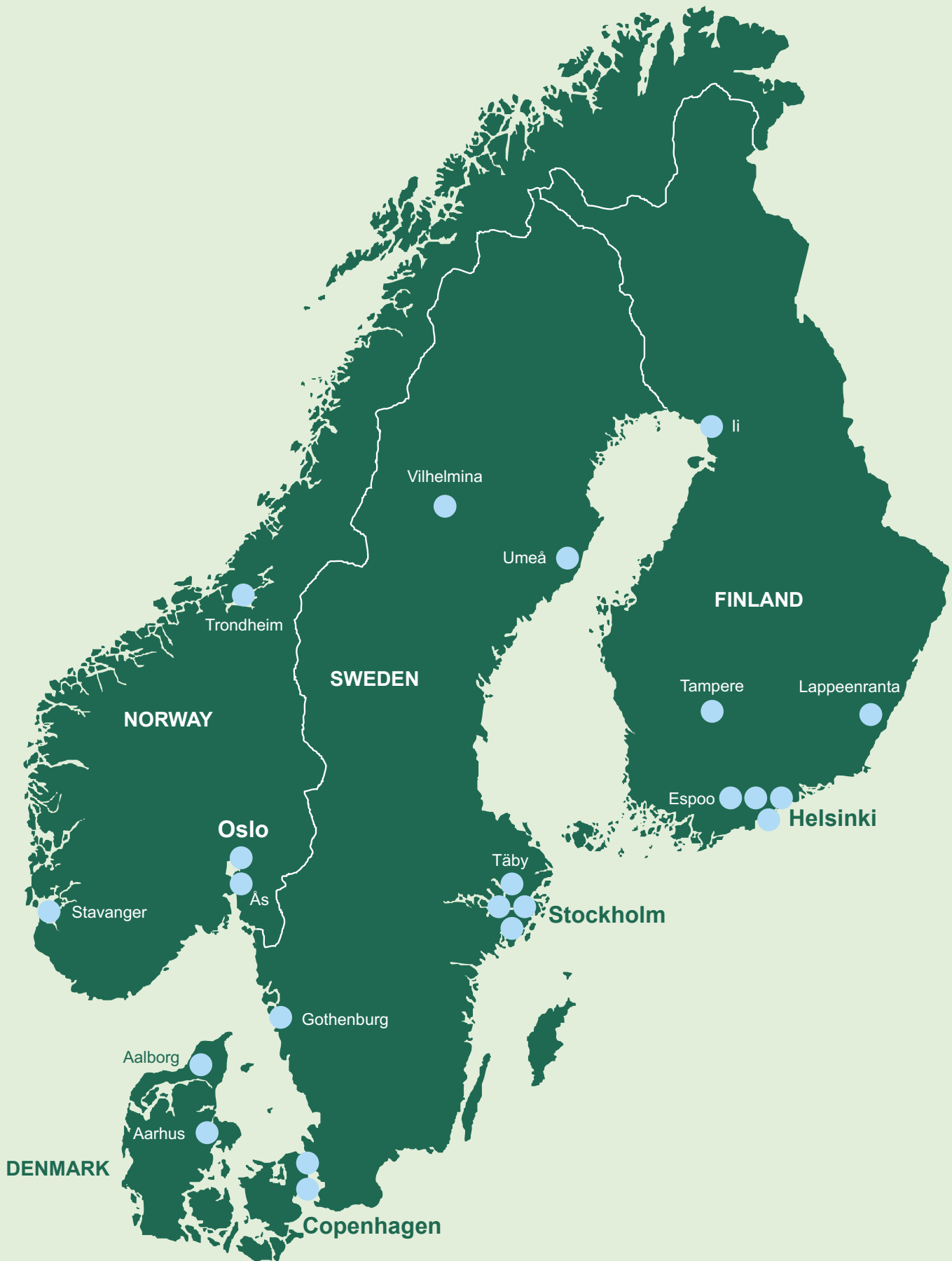
Overview of funded projects

The Nordic initiative on Sustainable Urban Development and Smart Cities defines the focus of the projects through its two main overarching perspectives:

6. *co-production as a means of expanding research activities to bridge gaps between knowledge, understanding, and action; and*
7. *integration of different dimensions of urban sustainability in the framework of the UN Sustainable Development Goals.*

Funded projects	Primary objectives	City partners
Citizens as Pilots of Smart Cities (CaPs)	Supporting smart and sustainable urban development that is based on the ideas and inputs of citizens. Fostering citizens' knowledge and engagement in local decision-making processes.	Finland: Tampere, Tuusula, Lappeenranta Norway: Oslo, Lier Denmark: Copenhagen
Smart Planning for Healthy and Green Nordic Cities (NordGreen)	Supporting municipalities in designing urban green space for health and well-being. Moving beyond 'smartness' as just merely technical innovation to examining the potential for enhancing evidence-informed governance. Identifying the key features of green space for health and well-being.	Denmark: Aarhus Finland: Espoo, Ii Norway: Stavanger Sweden: Täby, Vilhelmina
SMARTer Greener Cities: Making Smart Cities Smarter and More Liveable Through Nature-based Solutions.	Developing and testing innovative tools and methods to integrate social, ecological, and technological systems (SETS) for better urban living. Emphasising technological and digital infrastructure to connect different sectors and tackle SETS complexity with green spaces and nature-based solutions at the forefront.	Denmark: Copenhagen Finland: Helsinki Sweden: Stockholm
Nordic participatory, healthy and people-centred cities (NordicPath)	Establishing a new model for citizens' participation and collaborative planning with a focus on urban air quality and the interlinked challenge of climate change. Engaging citizens in the process of socio-technological change. Investigating how technologies can facilitate the processes of collaboratively co-designing solutions towards shaping more liveable, healthy, and sustainable cities.	Denmark: Aalborg Sweden: Gothenburg Norway: Kristiansand Finland: Lappeenranta

In addition to the city partners, the map shows the locations of the universities and research institutes involved in the funded projects.



Key scientific findings

The findings of the four projects can be organised under two categories:

1. **infrastructural aspects of making cities more sustainable**
2. **co-production and meaningful and inclusive participation**

Diverse perceptions of urban green spaces: understanding social and demographic differences

The first category involves lessons about making cities more sustainable and improving the health and well-being of citizens, as well as cities themselves as well-functioning ecosystems. Cities are not merely an assembly of human-made artefacts; they are also ecosystems with interconnected social, ecological, and technological systems. **Urban green infrastructures are integral and significant factors in maintaining cities as ecosystems, as well as in alleviating stress and improving the well-being of citizens.** Research suggests that the perceived aesthetic qualities of the landscape as well as its soundscape may be potentially beneficial factors.⁵

Urban green infrastructures as health-promoting facilities also have important implications for equality and justice. Like all limited resources, the uneven distribution of urban green infrastructures can be a source of inequality and injustice. This is particularly the case for more disadvantaged neighbourhoods of cities, where hardship because of social and economic vulnerability can be further exacerbated by the limited availability of green infrastructures. The findings from the projects call for our attention to the distribution of green infrastructures, with increased sensitivity to their availability for different socio-demographic and socio-economic groups.⁶

However, it should also be noted that **urban green infrastructures are not perceived and experienced in the same way by different social and demographic groups in cities.** It is, therefore, important to emphasise that urban green infrastructures are not miracle cures; it is as important to understand their implications for different groups as it is to emphasise their positive contributions to urban lives and ecosystems.

5 Korpilo, S., et al. (2024) "Landscape and soundscape quality promote stress recovery in nearby urban nature: a multisensory field experiment", *Urban Forestry & Urban Greening*, 95, 128286

6 Aamodt, G., Nordh, H., & Nordbø, E. C. (2023). Relationships between socio-demographic/socio-economic characteristics and neighborhood green space in four Nordic municipalities—Results from NORDGREEN. *Urban Forestry & Urban Greening*, 82, 127894.

Local knowledge as a catalyst for democracy and legitimacy

The second category of findings stems from the projects' innovative approaches to generating practical, applicable, and policy-relevant knowledge with increased *citizen engagement and participation*. These findings resonate strongly with the initiative's emphasis on co-production, and the use of digital participatory methods that can be developed in smart city frameworks. The projects thus present new perspectives on using smart tools to increase citizen engagement and participation, to complement scientific research with knowledge generated through citizen engagement and, more broadly, to improve forms of engagement between decision-makers, experts, and the public, thus potentially nurturing a more inclusive and democratic ethos.

The projects highlighted the importance of *local knowledge* for informing local planning solutions. **Local knowledge and its integration into planning practice has the potential to bring diverse realities of people and their day-to-day life practices into the frame.** Some projects explicitly highlight that a place-based approach may help to set priorities by introducing local knowledge from day-to-day life into planning practice, such as by connecting environmental characteristics and design with personal experiences and behaviour.⁷

The projects demonstrate that the use of *digital participatory methods* carries the potential to better understand green infrastructures and their significance for the people who use them. Such methods allow researchers to identify places and the values attached to them, negative or positive, by urban residents, who themselves contribute to the production of knowledge. **Consequently, the citizens' local and experiential knowledge, as well as their values, can be incorporated into formal planning procedures, which is key for democracy, legitimacy, and participation.** The data gathered can then be used to diagnose problems or gaps in existing green spaces and in the designing of green spaces of different scales and scopes that cater for the various health and well-being needs of different people. The challenge remains, however, to translate the vast amounts of data and local knowledge into workable planning solutions, which points to the need to complement the use of such tools with other participatory and co-production-oriented processes and procedures.⁸

7 Kyttä, M. et al. (2023). Prioritizing participatory planning solutions: Developing place-based priority categories based on public participation GIS data. *Landscape and Urban Planning*, 239, 104868.

8 Kajosaari, A. et al. (2024). Predicting context-sensitive urban green space quality to support urban green infrastructure planning. *Landscape and Urban Planning*, 242, 104952

Digital participation methods and tools offer numerous possibilities

Public Participation GIS (PPGIS) is one of the most widely used place-based digital participatory planning tools applied across the projects. PPGIS are online, digital, map-based surveys that have been applied by hundreds of cities in order to realise large-scale public participation and to collect place-based knowledge from individuals in large numbers. In addition, it enables vulnerable or marginalised social groups to be reached. This tool has the potential to register community voices and citizens' subjective perspectives, including the meanings and values that they attach to specific places. Consequently, the use of such tools has the potential to establish links between smart city practices and green initiatives, including the planning of urban green infrastructures, and nature-based solutions in general. Furthermore, **the use of such tools, complemented by deeper qualitative research, has the potential to reveal a sense of place shared by citizens that stands in stark contrast to the official framing of stigmatised neighbourhoods.**⁹

Citizens' experiential, local knowledge is a vital component of urban planning, and PPGIS can offer practitioners the opportunity to gather map-based experiential knowledge in order to provide insight for planning, designing, and managing green infrastructures. This tool allows researchers to map citizens' use of and interaction with places, integrating both landscape and, if desired, soundscape perceptions.¹⁰ Consequently, both perceived and objective indicators for access to green space and for health are gathered in order to make a more comprehensive evaluation of how citizens access and use green spaces, and the implications for their health and well-being.

Another digital participation tool employed by the projects saw the creation of *interactive innovation platforms*. Such platforms are designed to bring citizens, businesses, and other stakeholders together to work on identifying problems and devising solutions. Such platforms, especially if used starting from the early phases of planning interventions, **allow municipalities to engage different social groups, and provides a broader spectrum of approaches.** Importantly, such platforms have the capacity to engage not only different social groups, but also different age groups through, for example, the use of digital games as a tool for engaging a younger population.

9 Maurer, M. et al. (2023) "A social-ecological-technological system approach to just nature-based solutions: a case of digital participatory mapping of meaningful places in a marginalized neighbourhood in Copenhagen, Denmark", *Urban Forestry & Urban Greening*, 89, 128120

10 Korpilo, S. et al. (2023). Developing a Multi-sensory Public Participation GIS (MSPPGIS) method for integrating landscape values and soundscapes of urban green infrastructure. *Landscape and Urban Planning*, 230, 104617

The projects point to other possibilities for engaging broader audiences, albeit not as participation tools as some of the other methods used. *Citizen science* can also be used to engage citizens to contribute to the production of knowledge, an example of which is *environmental co-monitoring*, which involves the engagement of citizens in measuring air quality in an attempt to understand the effects of residential wood burning.¹¹ In this particular case, the researchers took advantage of the latest developments in air pollution technologies and used low-cost air quality sensors that were placed in the gardens of the participants' houses. The data gathered complemented data from official air quality monitoring stations, which enabled the researchers to create more accurate air quality maps to understand the adverse effects of residential wood burning. This example demonstrates how **citizens can contribute to data collection for more effective monitoring**, which might benefit decision-making through the provision of more data. However, this is an example of co-monitoring, not of co-production; the citizens are involved in the monitoring, but not in the processes that concern what happens to the data and how it is used.

The projects offer several other important lessons about the challenges of using participatory tools for citizen engagement. Some of these challenges are more scientific in nature, such as the calibration of the data, data quality, access, and storage. Other challenges relate to social relations and the politics of knowledge production, which may hinder both research and co-monitoring. These challenges include establishing trust (between citizens, city officials, and researchers), building confidence in citizen-collected data, maintaining citizen engagement over time, and aligning the motivations of citizens, city officials, and researchers.¹²

Balancing empowerment and realistic expectations in public participation

Across the four projects, a variety of novel methods of co-production have been deployed to reach out to, include, and engage various societal groups, especially those who are often excluded from conventional participatory practices in planning (e.g., public consultation). **Importantly, "the public" was often addressed in a more nuanced way; specific social groups were targeted, which enabled a more adequate and effective choice of tools and approaches for their engagement.** Some examples are: citizen engagement and public debate through the co-production of public data using the citizen science method (NordicPath); participatory budgeting (CaPs); engaging residents who had not previously been involved, in the future of the local public realm using PPGIS (NORDGreen); use of the online game (ByMaker) to reach school students (CaPs); inclusion of residents' perspectives in the urban planning process (UrbanPlanen) for a disadvantaged area (Smarter Green Cities); deployment of a PPGIS module for classroom teaching; and the use of Pavilions for immersive soundscapes.

11 Hassani, A. et al. (2023) "Low-cost particulate matter sensors for monitoring residential wood burning", *Environmental Science & Technology*, 57, 15162-15172

12 "The NordicPATH project: exploring best practices in citizen engagement using Urban Living Labs", not dated.

Such methods and tools give a sense of empowerment to the participants. It is important, however, to be very clear not only about how the participants can engage, but also about what the limitations of their engagement will be. This is important when it comes to giving them a more realistic sense of their feeling of empowerment.¹³ The projects, therefore, **recommend a more reflective use of digital tools for enhancing participation, communicating to the participating public very clearly what aspects of the projects they can influence and to what extent.**¹⁴ Otherwise, there is a risk that these tools will backfire, and generate a feeling of frustration rather than empowerment.

Lessons learnt and policy recommendations

One of the lessons learnt from the projects regarding *smart cities* is the need for a more holistic approach. This suggests that **approaching smart cities merely as a matter of technology is not** sufficient. In order to respond to citizens' needs for sustainable and healthier living environments, as much emphasis should be placed on social and ecological matters as on the technological ones in the development of smart cities. A more holistic framework brings these aspects together and sees them as interdependent.¹⁵

Smart city approaches can be used to encourage a sharper focus on citizen well-being, **not just through the application of technologies that improve urban life, but also by improving urban planning processes through knowledge-driven initiatives, innovative governance, and potentially more inclusive decision-making.** The projects adopt a variety of approaches, including Public Participatory GIS (PPGIS), digital participation tools, and citizen science practices such as environmental co-monitoring or mapping (where citizens participate in, for example, the monitoring of air quality or mapping of places of local significance). Not all these approaches encourage co-production, even though they potentially encourage citizen participation in the production of scientific knowledge and expand our repertoire of knowledge by incorporating local and experiential knowledge that might otherwise have been overlooked in conventional scientific practices or urban planning procedures.

13 Watne, K Å, et al. (2021) "Tackling data quality when using low-cost air quality sensors in citizen science projects", *Frontiers in Environmental Science*, 9, 733634

14 Toukola, S., & Ahola, T. (2022). Digital tools for stakeholder participation in urban development projects. *Project leadership and society*, 3, 100053.

15 Branny, A. et al. (2022) "Smarter greener cities through a social-ecological-technological systems approach", *Current Opinion in Environmental Sustainability*, 55, 101168

Another key lesson is the *importance of the context* where practical or research activities take place. Any challenges the researchers might face will be context-dependent, ranging from more fundamental challenges over which they do not have control (such as major budget cuts) to seemingly more minor ones that nevertheless pose significant challenges in the field (such as changing contact persons for recruiting citizens or changes in municipal personnel during the research period).¹⁶ This implies that there is no failproof method; researchers will need to adapt to the challenges they face in different contexts. **The key to more satisfactory stakeholder engagement seems to be the identification of common goals that would provide enough motivation for both the citizens engaged in the research and the local governments that seek to use research findings.**¹⁷ All methods, tools, and frameworks need to be contextualised by practitioners and adapted to existing planning processes and social contexts. This requires clear communication objectives, timeframes, and clarification of the extent to which the participating public can influence planning decisions.

It is also important to target different social groups more specifically through a more tailored combination of participatory approaches, not as one homogenous group of "citizens". Identifying different target groups and their specific characteristics, such as age, socio-economic status, or background, and designing participatory tools tailored specifically for different groups is likely to enhance participation. Such an approach would require not only using different digital tools, but also complementing them with other methods.

Conclusions

Despite the many opportunities they offer, cities also concentrate and intensify inequalities (economic, social, cultural, environmental, political), making them conspicuous, bringing the underprivileged and the privileged together in urban spaces.¹⁸ These inequalities are not only limited to income and wealth, but include social inequalities that produce persistent patterns of exclusion and injustice along racial, ethnic, gender, cultural, age, and disability lines, as well as, more recently, smart city technologies.¹⁹ These persistent inequalities pose several societal challenges, ranging from public health to urban riots, which undermine socially sustainable urban futures.

16 "The NordicPATH project: exploring best practices in citizen engagement using Urban Living Labs", not dated.

17 "Important aspects in urban participatory air quality governance: empirical evidence from the Nordic countries", draft.

18 Dikeç, M. (2017). *Urban Rage: The Revolt of the Excluded* (Yale University Press); Nijman, J. and Wei, Y.D. (2020) "Urban inequalities in the 21st century", *Applied Geography* 117; Tonkiss, F. (2020) "City government and urban inequalities", *City* 24(1-2): 286-301.

19 Caragliu, A. and Del Bo, C. (2020) "Smart cities and urban inequality", *Regional Studies* 56(7): 1097-1112

The findings of the projects help to address the challenges and themes targeted by the Nordic initiative, including sustainable cities and societies, reduced inequalities, inclusive societies, equal opportunities, good health and well-being, segregation, and balance of power in urban planning. Furthermore, they relate to several of the UN Sustainable Development Goals, such as Goal 3 - Good health and well-being, Goal 10 - Reduced inequalities, Goal 11 - Sustainable cities and communities, and Goal 16 - Peace, justice, and strong institutions.

The idea of "technologies of humility" is implicit in all the projects reviewed for this essay. Technologies of humility implies co-production and the improved, socially diverse, inclusive, and meaningful participation of the public. It calls for a culture of governance that promotes collective learning through more meaningful and constructive relations between decision-makers, experts, and the public. **Improved participation and interactive knowledge-making, or collective learning, improves both the quality and legitimacy of policy-making, and helps to make socially sustainable urban development initiatives more credible, transparent, and accountable.** These ideas run through the four projects, both in their methodologies and in how different approaches to smart technology are applied to social sustainability in practice.

The public is more aware than ever of the ways in which science and technology affect not only their day-to-day lives and interests, but also their values. This awareness has become even more marked since the COVID-19 pandemic and, more recently, the energy crisis in Europe. This in turn has significant implications as it raises the bar for the legitimacy and acceptance of transformations, requiring greater levels of transparency, accountability, and inclusion – which is as it should be in democratic societies. In this context, it is imperative to **consider ways of improving public engagement, not just in the formulation of solutions to perceived problems, but also in the ways in which problems are framed and narratives are created.** It is also imperative to **pay close attention to the potentially less-desirable implications of the increasing use of digital tools** in engaging citizens and collecting data, as suggested by the growing literature on *datafication and data justice*.²⁰

In building further on the outputs of the four projects within the initiative, it may be advantageous for cities outside of the project to learn from the experiences and practices of the participating cities, and to engage in discussion and dialogue around successful practices for increasing inclusive public engagement in planning. One possible step forwards could be the creation of a *Nordic Platform* devoted to methods for enhancing public participation. Such a platform would provide a *forum* for exchange between researchers and various stakeholders, a *repertoire* of best practices and lessons learned from failures, a *stage* for increasing the visibility and legitimacy of digital participation methods in knowledge production, and a *laboratory* for practicing technologies of humility in the search for more sustainable and democratic urban futures.

20 Kitchin, R. et al. (2019) "Citizenship, justice, and the right to the smart city", in P. Cardullo et al. (eds) *The Right to the Smart City* (Emerald Publishing), pp 1.24; Tedeschi, M. (2024) "Datafication and urban (in)justice: towards a digital spatial justice", *Geography Compass*, e12763.

Learn more

Visit the Sustainable Urban Development and Smart Cities webpage to learn more about the projects funded by this initiative.



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