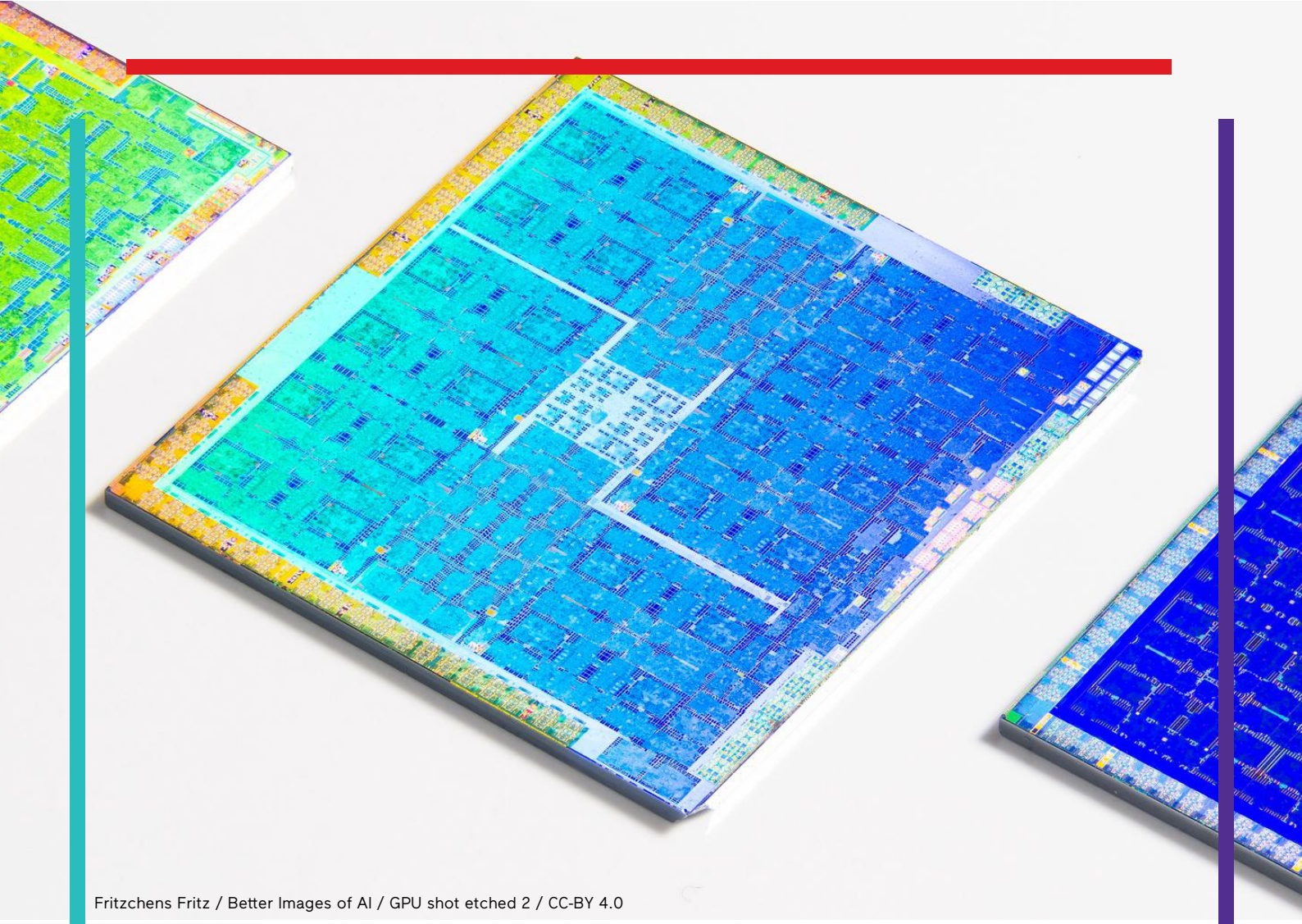

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Recommendations for the Use of AI and Other Disruptive Technologies in Public Processes

Lessons from Urbanite's development of mobility data ecosystems

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Executive Summary

Which factors influence the adoption and integration of disruptive technologies (e.g., artificial intelligence, machine learning, simulation and prediction models, mapping, data analysis) in public decision-making processes? Urbanite approaches this question through the lens of municipal efforts to develop local mobility data ecosystems that integrate various datasets and disruptive technologies. Our findings are relevant for all decision-makers (e.g., policymakers and civil servants) working with data and disruptive technology in a public role.

To gather the lessons and recommendations based on the Urbanite experiences, Waag conducted a co-creation workshop and internal interviews with the Urbanite partners and invited them to reflect on their experiences, the challenges they faced, and the lessons they learned from the process.

We identified several necessary steps for building an integrated mobility data ecosystem comprised of data and disruptive technologies, which each carry their own specific challenges. These necessary steps are:

- Identify the need for data and use / development of disruptive technologies
- Gain awareness of existing data
- Access existing data
- Ensure quality, cleanness, completeness, and accuracy of data
- Meet interoperability standards

Challenges in each of the above steps must be met before technical development of a larger data ecosystem can proceed. In addition to the challenges faced in these steps, there are also challenges in meeting other requirements such as ethical concerns around the development and use of technology in public decision-making. These requirements include:

- Human decision-makers (e.g., policymakers and civil servants) must understand and scrutinise the implications and limitations of technological outputs (e.g., data visualisations, models, and predictions).
- The use of data and disruptive technologies must be compatible with relevant laws and public values (e.g., regarding privacy and transparency).
- Technological outputs must be relevant for and usable by decision-makers.
- Technological outputs must be explainable to the extent that the steps of reasoning, sources, and considerations that lead to a recommendation or prediction must be able to be reproduced and validated by humans.
- Use of the technology must merit and earn trust by citizens, decision-makers, and other stakeholders.

Our recommendations for local policymakers are presented in the form of design process priorities. These design process priorities include:

- Participatory development
- Identification of a shared mission
- Modular and iterative development
- Open (standards / source / process)
- Education

The intended social impact of these recommendations is to help people work with data and disruptive technologies in a way that improves human decision-making and is worthy of public trust.

This text is an adapted version of the URBANITE deliverable "D2.6 Impact Analysis and Recommendations."[1] URBANITE has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement #870338.

[1] https://urbanite-project.eu/content/deliverables

1 Introduction

Municipal policymakers need to make educated decisions to shape the future of mobility in cities; there is a persistent assumption that these decisions can be facilitated by a data-driven platform.

The use of disruptive technologies (e.g., artificial intelligence, machine learning, simulation and prediction models, mapping, data analysis) in policy-making raises significant questions when applied in democratic societies that value human rights – and especially when applied by public institutions. These questions involve decision-making (*How is AI and other disruptive technologies [e.g. machine learning, simulations] utilised in a decision-making process?*); human oversight (*How is human oversight ensured?*); accountability (*Who is responsible for technological outputs, and how can processes involving disruptive technologies be made open?*); access & exclusion (*Who has access to use disruptive technologies, and what data do large models include?*), technology and development processes *(Who is included in development and how are models trained?)*; and trust (*How can AI and disruptive technologies be incorporated into democratic policy in a way that is worthy of public trust?*).

Urbanite partners organised participatory Social Policy Labs (SoPoLabs) in four pilot cities (Amsterdam, Bilbao, Helsinki, and Messina) to gain insight into the application of disruptive technologies to develop ecosystems of shared mobility data (mobility data commons). Sessions included local policymakers, civil servants, and other stakeholders from civil society. This revealed several challenges and opportunities related to the (lack of) trust of the public servants and end-users in the use of data and disruptive technologies.

The challenges in these steps and requirements provide the context for subsequent recommendations around the leading question of this deliverable: Which factors influence the adoption and integration of disruptive technologies (e.g., artificial intelligence, machine learning, simulation and prediction models, mapping, data analysis) in decision-making processes? Urbanite approaches this question through the lens of municipal efforts to develop local mobility data ecosystems that integrate various datasets and disruptive technologies. Our findings are relevant for all decision-makers (e.g., policymakers and civil servants) working with data and disruptive technology in a public role.

2 Challenges and recommendations

Urbanite partners recounted and evaluated their experiences leading up to, during and after the three SoPolabs through a series of interviews with Waag about challenges faced and lessons learned. The challenges and subsequent recommendations are relevant for any policymaker or decision-maker making use of disruptive technologies, especially policymakers and decision-makers involved in mobility at the municipal level.

2.1 Challenges (Necessary Steps)

The development of a local (mobility) data ecosystem is a complex process, in which challenges appear at each crucial step. These challenging yet crucial steps are:

- **Identify the need for data and use / development of disruptive technologies** – It is crucial that real needs of policymakers drive any technical development. The needs and problem that a technical solution intends to solve must be clearly defined at the outset. Some civil servants may be apprehensive to use new technologies because of the time investment, because they are already familiar with existing technology and processes, because of a lack of expertise in developing and implementing disruptive technologies, and because of a lack of trust that disruptive technologies and new ways of working with data will be helpful.

- **Gain awareness of existing data** – Once a need is established, development teams need to identify existing relevant data.

  Awareness of existing data is a challenge within municipalities for a variety of reasons (e.g., data silos, or a lack of interdepartmental communication) which are often organisational and bureaucratic in nature, rather than technical. Lack of awareness can lead to duplicated efforts and more data collection than is necessary.

  Communication between municipal departments is essential to know which data is available in each department and investigate the available opportunities for sharing that data for other purposes that may arise with the integration of new technologies. Municipality should facilitate interdepartmental data exchange, and consider setting up a data management position/team/department within the public administration to facilitate knowledge and data exchange between various (internal) departments and (external) stakeholders.

- **Access existing data** – Once a team is aware of existing data, that data is often difficult to access.

  There are many potential challenges to accessing existing data. Relevant proprietary data may be closed, costly, or gathered by private parties in a manner inconsistent with public values (e.g., gathered via dark patterns or surveillance capitalism). Public

data sets may also be difficult or impossible to access, for example due to interdepartmental access restrictions.
Challenges in accessing data are not always technical. Civil servants may be hesitant to use data due to the potential consequences of wrongfully sharing data (e.g., violating GDPR). Apprehensive civil servants may choose not to share the data at all, even in cases that are legally and ethically sound. Similarly, open data sets may not be accessible in practice if civil servants do not know when or how to handle them.

- **Ensure quality, cleanness, completeness, and accuracy of data** – Once data is accessed, there are various potential reasons why it may be unusable: data may be of a poor quality, unorganised, incomplete, or inaccurate.

  Development teams may face difficulty in identifying technical problems which (later) arise due to missing or otherwise problematic data. Problems with data at this stage in the process can lead to subsequent problems in development (e.g., when designing for interoperability and usability).

- **Meet interoperability standards** – Various high-quality data sources must also be interoperable in order to contribute to a larger data ecosystem.

  The lack of widely and consistently used open standards for various datasets (e.g., even within municipalities and municipal departments) is a major challenge for city-level data ecosystems and data commons. Data sets are often organised to suit an isolated use, domain, or context, and not optimised for collaborative use alongside other data sets.

  Despite these challenges, certain open standards are emerging which have been used in Urbanite.

Challenges in each of the above steps must be met before technical development of a larger data ecosystem can proceed. **Further requirements also pose crucial challenges** during development and use of data and disruptive technologies. These challenging requirements include:

- Human decision-makers must understand and scrutinise the implications and limitations of technological outputs (e.g., data visualisations, models, and predictions).
- The use of data and disruptive technologies must be compatible with relevant laws and public values (e.g., regarding privacy and transparency).
- Technological outputs must be relevant for and usable by decision-makers.
- Technological outputs must be explainable to the extent that the steps of reasoning, sources, and considerations that lead to a recommendation or prediction must be able to be reproduced and validated by humans.
- Use of the technology must merit and earn trust by citizens, decision-makers, and other stakeholders.

There are many complex challenges which arise from necessary steps in planning, developing, and using data and disruptive technologies in the context of decision-making and the development of data ecosystems. Such challenges can be overcome; a public design process with the right priorities can lead to the development and use of technology which both aids in human decision-making and earns societal trust.

2.2 Recommendations (Design Process Priorities)

Public design processes to develop local mobility data commons should prioritise:

- Participatory development
- Identification of a shared mission
- Modular and iterative development
- Open (standards / source / process)
- Education

Participatory development

Including 'end-users' (decision-makers) throughout the entire design process is the only way to ensure the relevance of technical solutions.

Start the development and implementation of disruptive technologies by identifying the problem owner. The problem owner should be data literate and educated about the implications and limitations of disruptive technologies. The technology should solve their problem, and they should be able to use this technology.

There are different stakes and interests even within the public administrations. Participation and communication with all relevant governmental levels (local, regional, national) is necessary.[2]

Participatory development should also include stakeholders from outside of the municipality, for example citizens, external experts and developers, researchers, and relevant private parties.

Identification of a shared mission

In the context of public tech development projects – those which are publicly funded, developed for public institutions, and/or used by public institutions – technology and design processes must align with public values. European public tech projects can look to existing shared values as the starting point for their *foundation*[3] (a set of goals, values, and assumptions that drives a development process); such values may already be defined both legally (e.g., GDPR, ECHR) and in public statements (e.g., in EU approach to artificial intelligence[4]).

[2] https://forumvirium.fi/simulaatioista-parempi-selkanoja-kestavalle-liikennesuunnittelulle/

[3] https://publicstack.net/layers/#foundation

[4] https://digital-strategy.ec.europa.eu/en/policies/european-approach-artificial-intelligence

While a shared mission is helpful in practical matters around collaborative tech development, more importantly it helps to ensure that the technology that furthers the mission of public institutions to protect public values including safety, privacy, and human agency.

Modular and iterative development

It is difficult to gather required data and meet demanding requirements. Any ecosystem that brings various datasets together should be built in several steps to ensure that the requirements are covered before developing new functions of a platform (e.g., modelling).

Modules should be able to function and serve a unique function on their own, but also be compatible and complimentary to a larger data ecosystem. Modular development should thus adhere to commonly accepted open standards to ensure compatibility and interoperability with a larger data ecosystem. Public administrations can then pick and choose the modular technical solutions that best fit their local context and challenges.

Modular development is supported by working iteratively and in sprints with smaller data sets. This helps clarify the project's direction and allows room for development to manoeuvre and change course. Prototypes developed during the sprints can be expanded upon later with larger data sets.

Visualisations and mock-ups are useful in mid-term feedback sessions, keeping conversation tangible and enabling participants to give valuable feedback without the technical solution needing to be completed. They can be a useful tool to bring developers together with end users and other stakeholders.

Modular development in this way helps to ensure that development is based on real needs in the city, and not just based on what is technically possible.

Open (standards / source / process)

Openness should be applied throughout development and in many different respects: open standards, open source, and open processes, to name a few.

As mentioned, open standards help to ensure interoperability. More so, open standards can be subjected to more widespread public scrutiny due to their openness. Not all open standards have high usability, and not all protect public values (e.g., privacy) by design: Developers should adopt and promote the use and development of open standards which are both functional and in line with public values.
Open source not a box to check, but rather a value to be pursued. There is a great difference between a so-called 'open source' code which is hidden on an unfindable government website, and an enthusiastically open-source project with quality documentation that fosters transparency, usability, replication, and public scrutiny. Going beyond code itself, the entire design process ought to be as open as possible, for example with open design sessions, openness about the project's governance and decision-making, and openness regarding the use of the final product or service.

Education

Education ought to occur in multiple directions during the entire participatory development process. On the one hand, developers are often not experts in the field they are developing for (e.g., mobility), and thus need to be educated on the specific needs faced by people in that field to avoid misunderstandings or unnecessary development. More importantly, however, decision-makers must also be educated throughout the participatory design process.

In order to make decisions based on outputs of disruptive technologies (e.g., traffic modelling outputs from AI), decision-makers must understand the implications and limitations of that technology enough to critically scrutinise it. Education in this regard must be socio-technical and multidisciplinary, beyond functionality and with a focus around ethical and democratically-minded considerations, for example regarding human rights (e.g., equality, privacy), human oversight & decision-making, inclusion & discrimination. Working with such technology in a decision-making capacity requires a deep and nuanced *data literacy*, the development of which is aided by active participation in co-creation sessions alongside others with diverse multidisciplinary expertise (e.g., in social sciences, data science, tech development).

This sentiment is laid out in the European Commission's *Strategic Research and Innovation Roadmap*:

> **"In order to achieve public trust in AI-systems, the user of an AI system needs to know when a system is operating out of bounds, and this also needs to be clearly communicated. So, a main point in this context is transparency. How can this be achieved? Education can be considered as a preparatory action, in particular in the context of public administrations, where a clear understanding of the overall framework for the potential introduction of AI in the processes is needed, as well as a maturing awareness concerning the limits and capabilities of AI."[5]**

Data and disruptive technologies are not magic wands; they are tools that need to be used, fed, interpreted. AI may be good at solving certain tasks, such as outputting simulations that test certain possibilities based upon limited assumptions; but does not predict the future, does not know what is best, and does not consider all factors and possibilities.

2.3 Social Impact (Informed Human Decision-making and Trust)

Informed Human Decision-making

The purpose of utilising data and disruptive technologies is to help humans make better, more well-informed decisions. However, the limitations and and implications of data and disruptive technologies are vast, complicated, far-reaching, and nuanced. Algorithms make mistakes, data sets are inherently biased, and black-boxed outputs cannot be explained; there are myriad reasons why human discretion should always be prioritised and protected when using technology within a public decision-making process. To this end, socio-technical data literacy

[5] https://tailor-network.eu/research-overview/strategic-research-and-innovation-roadmap/

regarding societal implications of data and disruptive technologies must be a prerequisite for any decision-maker that utilises them.

First and foremost, humans need to make decisions – not AI or other technology.

Beyond this simple tenant, it is also crucial that decision-makers have nuanced understanding of the complex context in which mobility data sits. Without such knowledge, a specific tool will not provide the correct feedback to steer decision making. For example, a simulation to improve traffic flow may recommend to build more roads. Building more roads, however, is contrary to sustainable development goals. Moreover, the simulation is likely to have been fed more data about cars and roads (which is relatively easy to gather) than about more sustainable modes of transportation like walking and cycling (whose data is more difficult to gather). Decision-makers and developers need to avoiding letting data sources determine design decisions, and instead make their own informed choices about what to optimise in their technology and decision-making processes.

Trust

Trust about the use of disruptive technologies is a prerequisite for their application in matters of society and governance. Trust applies on many levels in this regard and from the perspective of citizens and decision-makers alike, for example:

- trust that the data is accurate and reflective of peoples' lived experiences;
- trust that decision-makers are knowledgeable about the nuances and limitations of the; tech they are using, and are comfortable with using it;
- trust that decisions are made by humans (not technology);
- trust that privacy and other public values are ensured by the technical systems' design;
- trust that the technology is open and transparent;
- trust that outputs of AI are explainable valid;
- trust that (human) decisions informed by AI outputs are explainable and valid;
- and more.

It is not possible to achieve trust in these necessary instances without a participatory and educational design process that prioritises socio-technical data literacy and follows the necessary development steps. To quote one Urbanite partner,

> **"There can be no trust without understanding and scrutiny."**

In other words, the goal is not to develop trust amongst society (about the use of disruptive tech); but rather to build technology and protocols that merit public trust because of their openness and alignment with public values.

3 Conclusion

Stakeholders' concerns and focus are quite similar; they involve trust, public values, human decision-making, openness, and public involvement, and how to address these issues through concrete choices in technical design processes.

There is a persistent belief that data-driven technologies can pose solutions to contemporary urban mobility issues. Our findings point to the need for shared public values to form a foundation that guides urban mobility development through various challenging steps and requirements. Only then can decision-makers ensure that technical solutions are in line with the mission of democratic institutions; and only then can developers have a common ground to align and develop other necessities like access and interoperability.

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[6] https://urbanite-project.eu/content/deliverables