Navigating digital citizen participation: a comparative study of Leiden and Amstelveen

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Abstract

This study explores the challenges and benefits of implementing digital citizen participation at the municipal level, focusing on two medium-sized Dutch municipalities: Leiden and Amstelveen. Using Actor-Network Theory (ANT) and the Technology Enactment Framework, the research explores how digital tools enhance governance by improving transparency, accessibility, and inclusivity, while also addressing the barriers posed by the digital divide, privacy concerns, and organizational resistance.

This study adopts a comparative case study approach, analyzing secondary data from scientific literature, policy documents, and digital participation platforms such as Go Vocal. Findings reveal that Leiden emphasizes centralized, structured consultation processes, while Amstelveen employs decentralized, co-creative methods that empower local communities. Both approaches demonstrate the potential of digital tools to foster civic engagement and trust, though challenges such as sustaining long-term participation and ensuring inclusivity persist.

By synthesizing theoretical frameworks and empirical data, the study contributes to the field of digital governance and offers actionable insights for municipalities aiming to implement or refine digital participation strategies. The results highlight the importance of hybrid participation models, tailored strategies, and institutional capacity-building to create more inclusive and effective governance systems.

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Introduction

Technology has become a fundamental part of life, changing nearly every aspect of how people communicate and work. Accessing information and performing daily tasks have changed greatly, but the shift does not end there: municipalities have to change the way they interact with citizens. Conventional citizen participation, which includes physical meetings and paper-based communications, is gradually transforming into digital citizen participation, where citizens can engage with municipalities through online platforms, apps, and social media.

The importance of digitalizing citizen participation comes from the many benefits it can have; it can increase accessibility, enhance engagement, improve transparency, and be more cost-effective. Bouzgenda et al. (2020) demonstrate how digital platforms improve participatory planning processes in municipalities, providing citizens with easier ways to interact with local government initiatives. Digital platforms can help create more inclusive decision-making by reaching a broader demographic, including citizens who are traditionally excluded from in-person participation (Hasler et al., 2017). On top of that, Engvall and Flak (2022) emphasize the transformative potential of digital governance, noting that it can streamline administrative processes and enhance the transparency of government activities, which in turn can increase the amount of trust citizens have in their municipality.

On the other hand, implementing digital citizen participation can bring just as many challenges with it, like the digital divide, data privacy and security issues, or capacity limitations within a municipality. The digital divide is one of the biggest challenges; the unequal access to technology and the internet can marginalize certain groups, worsening existing inequalities (Kvasny & Keil, 2006). Local institutional arrangements can further

complicate the implementation of digital tools, as municipalities may be opposed to change or struggle to integrate them (Luna-Reyes & Gil-Garcia, 2011). Concerns about data privacy and security may also lead to citizens withholding their participation. If citizens perceive inadequate data protection, they might be reluctant to participate on digital platforms (Shin et al., 2024). The design of digital platforms must also consider user-friendliness and accessibility to ensure that all citizens, regardless of their technical abilities, can participate meaningfully (Latour, 2007; Teles & Joia, 2010).

Although all of the studies mentioned above research digital citizen participation and mention one or two benefits or challenges, none of them have studied both and compared them between two municipal cases. This study addresses the question: *What are the key challenges and benefits associated with implementing digital citizen participation at the municipal level of Leiden and Amstelveen?* It seeks to identify and describe challenges and opportunities related to digital citizen participation while also trying to understand the current situation in Leiden and Amstelveen. The main question is supported by four subquestions:

1) What are the potential benefits of digital citizen participation at the municipal level?
2) What are the social challenges with implementing digital citizen participation at the municipal level?
3) How is digital citizen participation currently implemented in Leiden and Amstelveen?
4) How do the challenges and opportunities differ between Leiden and Amstelveen?

All subquestions are descriptive, with the first two being answered by using existing scientific literature and the last two being answered by conducting a comparative case study using existing literature, policy documents, and news articles.

The scientific relevance of this research is the possibility to expand our understanding of how technology affects public engagement with governance, contributing to the field of

digital governance. By using multiple theoretical frameworks in a comparison, it can get easier to build new frameworks for implementing digital citizen participation platforms, which benefits theoretical research. Next to that, new insights are offered into how citizens and technology interact in municipalities, which benefits applied research.

The societal relevance of this study is that it presents opportunities to make municipal policy-making more inclusive and transparent, which improves citizen participation. Identifying challenges and opportunities will allow municipalities to better engage with all their citizens, including those who are not technologically advanced. Besides that, increased digital citizen participation can help build better trust between municipalities and citizens because of the potential to create more transparency by participating digitally.

This research will fill the gap of understanding the specific challenges and benefits that come with implementing digital citizen participation at the municipal level in two medium-sized Dutch cities, Leiden and Amstelveen, using a comparative analysis. This is meant to offer insight into how local institutional factors influence the successes or limitations of implementing digital citizen participation. Furthermore, it will contribute to the development of a tailored model for municipal-level digital citizen engagement, building on existing frameworks like the Technology Enactment Framework (Luna-Reyes & Gil-Garcia, 2011) and the model based on the Actor-Network Theory by Yusuf et al. (2016).

Theory

Concepts

Digital citizen engagement refers to the involvement of citizens in policy-making processes via digital instruments (Shin et al., 2024). These digital tools encompass applications enabling residents to report problems in public areas, such as malfunctioning streetlights or loose paving stones, as well as online venues for individuals to offer feedback

on current municipal projects. Shin et al. (2024) examined an extensive dataset of 116 digital participatory tools from three public data repositories to discern predominant global patterns. The digital participatory platform MinStad allows Swedish citizens to contribute to urban planning by marking suggestions on digital maps. This tool increases accessibility and engagement by enabling participation regardless of time or location constraints (Helldén & Zhao, 2020). On the contrary, certain municipalities in the United States have encountered difficulties with low engagement rates and digital exclusion during the implementation of digital platforms (Le Blanc, 2020). These examples illustrate how local governance frameworks, technology competencies, and cultural elements can affect the results of digital citizen engagement tools.

The progress of digital citizen engagement has been characterized by changes in technological advancements, citizen expectations, and regulatory mandates. Initial activities were mostly focused on digital communication mediums, such as email and online surveys; however, current strategies use sophisticated tools like artificial intelligence to improve the efficiency of processing public feedback (Le Blanc, 2020). Additionally, hybrid participation methods, which integrate conventional in-person meetings with internet tools, are gaining popularity, especially in municipalities that have just started to shift toward digital engagement. While digital tools offer unmatched convenience and scalability, traditional methods such as in-person workshops and community meetings remain vital for reaching certain demographics. Hybrid models address the limitations of digital-only approaches by ensuring inclusivity and fostering trust through direct interactions. In the U.K., municipalities such as Bristol have implemented a hybrid model to promote inclusivity, enabling individuals to participate in town hall meetings either digitally or in person, in so doing accommodating those lacking a dependable internet connection or the know-how to use it (Cardullo & Kitchin, 2019).

Challenges associated with digitizing citizen participation include the digital divide (Kvasny & Keil, 2006) and a lack of confidence from municipal officials toward citizens (Bouzgenda et al., 2020). To enhance confidence, it is recommended to maintain conventional citizen involvement and gradually transition to digital participation (Bouzgenda et al., 2020). The primary advantages of citizen participation are better civic engagement and increased approval of policies and projects (Hasler et al., 2017). A possible benefit of digitizing citizen participation is that civic engagement becomes more accessible, allowing residents to participate from the comfort of their homes. Moreover, it would reduce the necessity for face-to-face meetings and correspondence through letters. However, these prospective benefits highlight a gap in the literature: digital citizen participation has not yet surpassed traditional citizen participation in terms of research.

Case studies of both successful and unsuccessful digital citizen involvement deployments offer significant insights into their potential advantages and obstacles. Barcelona's implementation of Decidim for collaborative urban planning projects resulted in significant engagement, highlighting the necessity of transparent and accessible platforms (Barandiaran et al., 2024).

Actor-Network theory

This study is based on one theory and one framework: the Actor-Network theory (ANT) and the Technology Enactment Framework that is derived from the institutional theory. The ANT has been created to help researchers understand complex systems involving humans (like citizens) and non-humans (like digital tools), while treating both as equally important in shaping outcomes (Latour, 2007). Actors interact with each other, creating dynamic, developing networks. The ANT previously has been used to develop a model of digital inclusion in the municipality of Piraí (Teles & Joia, 2010). The main findings of this study were that the public sector plays a critical role in creating a digital city because it

supports the key phases of ANT: translation (where actors align interests) and enrollment (where actors agree to participate in the network). The main focus of the study of Teles & Joia (2010) is somewhat similar to this study: both digital inclusion and digital citizen participation share a focus on how people interact with digital technology. The Actor-Network Theory is highly relevant for studying digital citizen participation in municipalities because it allows researchers to observe how human and non-human actors collaborate, conflict, and negotiate within a digital participation system. ANT provides a framework for uncovering the interactions between citizens (as individuals or groups), the municipal government, and digital tools such as the Go Vocal platform. By analyzing these interactions, it becomes easier to understand the formation and development of digital participation networks, which results in the identification of where alignments or breakdowns occur, which in their turn can be tied to benefits and challenges.

In 2016 a study was published by Yusuf et al., in which they researched the digital citizen participation within schools in the United Kingdom and India, using the ANT. They summarized the key concepts in a table (*Table 1*).

Concept	Description
Actor (or Actant)	Both human beings and non-human actors
Actor-network	Heterogeneous network of aligned interests, as follows: people, organizations, and standards
Enrollment and translation	Creating a body of allies, human and non-human, through a process of translating their interests to be aligned with the actor-network
Delegates and inscription	Delegates are actors who “stand in and speak for” particular viewpoints that have been inscribed in them

Irreversibility	The degree to which it is subsequently impossible to go back to a point where alternative possibilities exist
Black box	A frozen network element
Interresment	A process of convincing the other actors to accept and recognize definition of the focal actor
Immutable mobile	Network element with strong properties of irreversibility and effects that transcend time and place

Table 1: Summary of some key concepts in Actor Network Theory (ANT) (Yusuf et al., 2016)

Yusuf et al. (2016) used these concepts and their own research into schools to develop a model of digital participation within schools. This model serves as an example for coding the articles regarding ANT, digital citizen participation, and the Technology Enactment Framework. It highlights both effective and ineffective network interactions, which can be associated with benefits and challenges.

Enrollment and translation

ANT's concepts of enrollment and translation are particularly valuable for understanding how municipalities align the interests of diverse actors in digital participation systems. Enrollment refers to the process of engaging actors to participate in the network, while translation involves redefining their interests to align with the network's goals (Latour, 2007).

In Leiden, for example, the municipality might work to enroll citizens by emphasizing the benefits of using the Go Vocal platform, such as convenience and transparency. At the same time, they translate citizen concerns about urban development into actionable data that can be used to improve municipal policies. Similarly, in Amstelveen, the municipality might focus on enrolling different age groups to ensure broad participation, addressing concerns about accessibility for elderly residents through user-friendly platform design (Gemeente

Amstelveen, 2023). Amstelveen's efforts to co-create greener spaces through Go Vocal showcase a successful example of enrollment, where citizens' environmental concerns were translated into actionable projects supported by municipal initiatives (Fillet, 2023a).

During these processes, challenges appear. Citizens might resist enrollment due to distrust in government intentions or due to the digital divide (Kvasny & Keil, 2006). If citizen feedback is not adequately represented or if technical constraints limit the responsiveness of the platform, the translation could fail (Teles & Joia, 2010). By mapping these dynamics through ANT, this study can identify specific points where interventions might improve participation outcomes.

Using ANT to analyze the actor-networks in Leiden and Amstelveen can highlight how different approaches to digital citizen participation yield varying challenges and opportunities. For instance, while Leiden might focus on a single platform for cohesion, Amstelveen's multi-platform approach might offer more tailored participation options but introduce complexity in aligning actor interests (Fillet, 2023a). Amstelveen's focus on fostering a participatory culture with its internal organization further illustrates the intricacies of municipal digital networks (Fillet, 2023a). ANT's framework enables a detailed examination of these dynamics, offering insights into how to optimize digital participation networks for better inclusivity and effectiveness.

Technology Enactment Framework

The Technology Enactment Framework developed by Fountain (2004) is derived from the institutional theory. Institutional theory is used to explain how institutions (such as municipalities) adopt new practices, including technologies, under the influence of external pressures, norms, and internal dynamics (Scott, 2004). Institutional theory consists of three pillars: regulative, normative, and cultural-cognitive. These pillars support institutions, showing how these elements collectively shape both the stability and change of factors within

organizations (Scott, 2004). The regulative pillar involves formal sanctions, laws, and rules; the normative pillar is built upon values, norms concerning appropriate behavior, and social commitments; the cultural-cognitive pillar underlines the importance of shared beliefs, symbols, and understandings that describe reality and navigate actions (Scott, 2004). This theory can give me a perspective to understand how societal norms, laws, and municipal structures influence the design and adoption of digital platforms. The Technology Enactment Framework integrates technology as an essential element of the analysis (*Figure 1*). According to Luna-Reyes & Gil-Garcia (2011), "it could be considered one of the most refined and integrated institutional approaches to the study of technology in organizations, particularly government agencies." The framework makes use of the intersections between information technologies, organizational forms, and institutional arrangements to turn 'objective technologies' (all possible features a technology has to offer) into 'enacted technologies' (the features that are actually implemented and used) (Luna-Reyes & Gil-Garcia, 2011). This framework can help explain how digital tools are shaped by local institutional arrangements and organizational forms. Challenges and benefits can be categorized using specific institutional or organizational components; challenges could be classified under 'technical barriers' because of weak infrastructure or under 'organizational resistance' based on structural inflexibilities. Benefits might fall under categories like 'enhanced citizen engagement' because of flexible digital platforms or 'improved transparency' enabled by well-designed policy frameworks. The 'enacted technologies' in this study would be the digital citizen platforms that Leiden and Amstelveen use.

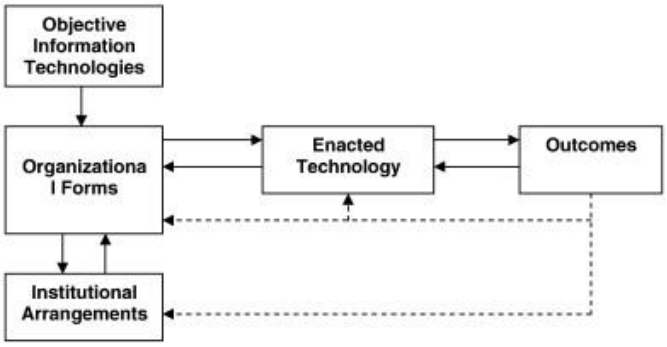

Figure 1: Technology Enactment Framework (Fountain, 2004).

Objective and enacted technologies

The distinction between "objective technologies" and "enacted technologies" has been explored in several public sector studies. For instance, in the implementation of open data platforms in municipalities, the “objective technologies” often include a wide range of features such as real-time data visualization, data interoperability, and automated reporting. However, due to institutional constraints like insufficient technical expertise or funding, only basic data-sharing features are "enacted," leading to limited usability (Meijer & Bolívar, 2016).

In another example, municipal efforts to implement e-governance platforms frequently encounter misalignment between the "objective" capabilities of these platforms and institutional norms. In Indian municipalities, studies revealed that despite platforms being equipped to handle multilingual citizen interfaces, the enacted technologies often fail to provide this feature due to inadequate planning and infrastructure (Srivastava & Teo, 2007). These examples highlight how institutional arrangements, such as resource availability and organizational resistance, directly shape the enactment process.

Institutional arrangements

Institutional arrangements play a pivotal role in how municipalities select and implement digital tools. For example, the decision to adopt platforms like Go Vocal in the Netherlands involves a balance between regulatory compliance (regulative pillar), alignment with municipal values (normative pillar), and citizen expectations for user-friendly interfaces (cultural-cognitive pillar). However, this balance is often disrupted when institutional norms conflict with technological capabilities. A relevant case is the Amsterdam Smart City initiative, which was unsuccessful in fully adopting its envisioned digital engagement platform due to a lack of collaboration among stakeholders and inadequate funding (Anthopoulos & Fitsilis, 2013).

Similarly, the cultural-cognitive pillar can influence the enactment of technologies. Municipalities with conservative governance cultures may enact only minimal features of participatory platforms, viewing extensive digital engagement as a threat to existing power structures (Cardullo & Kitchin, 2019).

Interaction with ANT

The Technology Enactment Framework complements Actor-Network Theory (ANT) by focusing on the institutional and organizational contexts within which actor-networks operate. While ANT emphasizes the interplay between human and non-human actors, the enactment framework provides a structured lens to analyze how these interactions are constrained or enabled by institutional norms and organizational forms. For instance, while ANT might explore how citizens and digital platforms co-shape participation, the enactment framework would analyze how municipal regulations and cultural expectations influence which platform features are implemented and how they are used. Together, these theories provide a comprehensive view of digital citizen participation.

Institutional barriers to enactment

Several institutional barriers prevent the full enactment of technologies in municipalities. Resistance to change is a recurring issue, particularly among municipal employees who perceive digital platforms as threats to their traditional roles. Resource limitations, such as insufficient budgets or lack of skilled IT staff, further restrict the enactment of advanced technological features (Meijer & Bolívar, 2016). In addition, regulatory frameworks can create unintended obstacles, such as stringent data privacy laws that limit the functionality of digital participation tools. Addressing these barriers requires a nuanced understanding of institutional dynamics, which the Technology Enactment Framework provides.

Methods

Case study

This study utilizes a qualitative approach with a comparative case study method in order to research the implementation of digital citizen participation in two municipalities: Leiden and Amstelveen in the Netherlands. The challenges and opportunities that both municipalities have encountered or are yet to encounter will be compared to each other, next to how the context of each city shapes their implementation of digital tools in citizen participation.

A comparative case study is the best fit for identifying the challenges and opportunities that can come with implementing digital citizen participation, since it provides in-depth insight, mainly coming from the Go Vocal platform that is used in Leiden and the several different digital platforms that Amstelveen uses (Fillet, 2023a). The comparative case study method allows the exploration of the contextual factors, such as differences in governance structures, that might influence the implementation of digital citizen participation.

Unlike other methods, a qualitative case study provides a more in-depth insight into interactions between municipalities, citizens, and digital tools.

These specific cases were chosen because of their similar population sizes and their active use of digital tools in citizen participation. Besides that, both municipalities use their digital citizen participation in the field of urban development and urban planning, ensuring that they have a similar scope to compare (Fillet, 2023b.; Fillet, 2024). The selection of Leiden and Amstelveen is particularly relevant to the research question for several reasons. Both municipalities have similar population sizes, which allows for a balanced comparison. However, their demographic characteristics differ in meaningful ways: Leiden has a higher proportion of students and young professionals (Appendix B), while Amstelveen's population includes a significant number of expatriates and families (Appendix C). These differences provide a unique opportunity to examine how varying demographics shape digital citizen participation strategies.

Technological infrastructure also sets these municipalities apart. Leiden's initiatives focus on integrating digital tools into smart city projects, while Amstelveen's approach is more oriented towards fostering community engagement through user-friendly platforms. Comparing their governance models, Leiden's more academic, innovation-driven focus versus Amstelveen's practical, community-centric approach enables a nuanced analysis of the factors influencing the adoption and effectiveness of digital tools (Fillet, 2023a.; Fernández-Caballero et al., 2022). Moreover, the Netherlands is widely recognized as a leader in digital governance and innovation. Studying Leiden and Amstelveen within this context not only highlights their local challenges and opportunities but also provides insights into broader trends in digital citizen participation (Meijer & Bolívar, 2016).

This research design allows for a detailed comparison of two municipalities in the Netherlands in order to understand what impact challenges and opportunities can have on implementing digital citizen participation.

Data collection

This study primarily relies on secondary data sources to examine the implementation of digital citizen participation in Leiden and Amstelveen. The selected data sources include scientific articles, policy documents, technical reports, official statements from municipal governments, and reliable online materials such as news articles and municipal websites. These diverse sources offer a comprehensive basis for understanding the dynamics of digital participation platforms and their contextual challenges and opportunities in the two municipalities.

To ensure data relevance, sources will be categorized as follows:

- Scientific literature: Foundational theoretical insights and contextual analyses will be drawn from peer-reviewed articles. For instance, Shin et al. (2024) conducted a systematic analysis of 116 digital participatory tools, offering valuable statistics for assessing digital participation platforms.
- Policy documents and technical reports: These documents, issued by government and municipal institutions, provide information on strategic objectives, technical implementation, and regulatory frameworks influencing digital citizen participation in Leiden and Amstelveen.
- Municipality websites and official statements: The official websites of the municipalities will serve as key data sources, offering details on specific digital platforms such as Go Vocal. These resources are essential for understanding the institutional context and municipal goals.

- News articles: Media reports will supplement academic and official sources by providing updates on local developments and public responses to digital participation initiatives. Reliable sources will be prioritized, including those from established news outlets or verified local platforms.

Search strategy

To systematically identify relevant data, a structured search approach will be employed. Keywords such as "digital citizen participation," "Leiden municipality," "Amstelveen municipality," "urban planning," and "digital governance" will guide the searches. Boolean operators (e.g., and, or) will be used to combine terms and refine the results. Searches will target the academic database Google Scholar, in addition to the municipalities' official websites and other reputable sources.

The selection process will follow defined inclusion and exclusion criteria, with inclusion criteria sources that must focus on digital citizen participation, municipal case studies, or relevant theoretic frameworks. Exclusion criteria include outdated materials or sources lacking credibility.

To ensure a focus on recent developments, the search will prioritize studies and reports published within the last five years, supplemented by older foundational works like Scott (2004) and Fountain (2004) for theoretical insights.

Existing dataset

A core dataset central to this study is provided by Shin et al. (2024), who analyzed 116 digital participatory tools from general contexts. This dataset categorizes platforms based on their functionality, user engagement methods, and policy implications. Their study employs a mixed-method approach, combining qualitative and quantitative techniques to identify trends in the design and deployment of digital participation tools. For this research, relevant insights will be extracted, particularly regarding tools analogous to those in Leiden and Amstelveen.

Limitations

Relying on secondary data presents certain challenges, like potential bias, terminological variability, and data availability. To mitigate these limitations, this study will triangulate findings from multiple data sources, ensuring validity and reliability in interpretations. Additionally, care will be taken to critically assess source credibility, particularly for non-academic materials.

Data analysis

The data analysis will follow a content analysis, a qualitative method for systematically examining textual and other forms of data to uncover patterns, themes, and relationships. This approach is particularly useful for investigating how municipalities implement digital citizen participation platforms and for identifying associated challenges and opportunities. The analysis combines theoretical frameworks and empirical data, with Microsoft Excel used for organizing and interpreting the material (Bree & Gallagher, n.d.; Scribbr, n.d.).

The process begins with familiarization, where the data, such as policy documents, platform descriptions, and academic articles, are thoroughly reviewed to identify recurring ideas and insights. Immersion in the material is essential for building a deep understanding of the content. Key segments are then coded based on predefined criteria linked to theoretical frameworks (Appendix A). These codes are subsequently grouped into broader themes, which help to identify patterns and relationships within the data. Themes such as accessibility and trust provide a structure for interpreting the findings.

Microsoft Excel

Microsoft Excel plays a central role in organizing and analyzing data. Following the method outlined by Bree and Gallagher (n.d.), excerpts from the material are documented in a spreadsheet, and relevant codes are applied systematically. Excel’s capabilities, such as

sorting, filtering, and pivot tables, facilitate the categorization and theme identification process. This approach enables the systematic identification of strategies employed by each municipality, such as transparency measures or efforts to improve accessibility.

Operationalizing theoretical concepts into measurable variables is a key element of the analysis. For instance, accessibility is assessed through indicators like platform usability and mobile compatibility, while trust is evaluated by examining transparency initiatives and mechanisms for citizen feedback (Appendix A). The digital divide is analyzed using data on internet access, digital literacy, and demographic disparities. These indicators ensure that the findings are conceptually grounded and directly linked to theoretical frameworks such as the technological enactment framework and the Actor-Network Theory.

The comparative nature of the study enhances its analytical depth. Common themes, such as approaches to citizen engagement, are examined within the context of both municipalities, while differences between the cases shed light on how local conditions and governance structures shape digital initiatives. This comparative perspective ensures a comprehensive understanding of the factors that influence the adoption and effectiveness of digital citizen participation platforms.

To ensure reliability and validity, the analysis incorporates strategies like triangulation and systematic review. Data from multiple sources, including policy documents and online platforms, is cross-referenced to validate findings. Additionally, the coding scheme is reviewed by peers. These measures address potential biases and enhance the robustness of the analysis (Scribbr, n.d.).

Results

This chapter systematically addresses the subquestions to unpack the multifaceted nature of digital citizen participation, researching its benefits, challenges, the current

implementation in Leiden and Amstelveen, and comparative insights between the municipalities. As a result, the answer to the main question, *'What are the key challenges and benefits associated with implementing digital citizen participation at the municipal level of Leiden and Amstelveen?'*, can be formulated in the concluding chapter of this study.

This chapter starts off with investigating the potential benefits of digital citizen participation, focusing on how different digital tools can enhance governance. By drawing on the theoretical frameworks of Actor-Network Theory (ANT) and the Technology Enactment Framework, it highlights how digital tools can improve transparency, inclusivity, accessibility, engagement, and digital participatory planning and make them benefits of digitalizing citizen participation. The analysis is supported by empirical evidence coming from general scientific literature, showing the potential of digital tools in governance.

For the second part, the social challenges of implementing digital citizen participation are addressed. Issues such as the digital divide and privacy concerns are explored, which sheds a light on the challenges municipalities face when integrating digital tools. Theoretical frameworks are combined with existing literature to emphasize the complexity of these challenges and the possible solutions.

Next, the current situation of the implementation of digital citizen participation in the municipalities of Leiden and Amstelveen is explored. This part examines the platforms, tools, and policies employed by each municipality, providing a detailed description of their strategies and practices. The analysis highlights both successes and limitations, offering a nuanced understanding of how these municipalities approach digital citizen participation.

Finally, Leiden and Amstelveen are compared to each other, identifying key similarities and differences. This comparative analysis reveals how local contexts, governance structures, and institutional behaviors shape the implementation and impact of digital citizen

participation. By using findings from the previous sections, this part offers broader insights into the factors that influence the success of digital tools in municipal governance.

Potential benefits

For the first subquestion, this study delves deeper into the potential benefits that digital citizen participation can create. The codes from the category ‘Digital citizen participation’, which include digital participatory planning, accessibility, transparency, civic engagement, and inclusive participation, are all benefits that can come from implementing digital citizen participation (Appendix A). Using Actor-Network Theory (ANT) (Latour, 2007) and the Technology Enactment Framework (Fountain, 2004), these benefits can be understood through the interactions between human and non-human actors and the institutional contexts that shape how digital tools are implemented and used.

ANT examines how human actors (citizens, municipal officials) and non-human actors (digital platforms, algorithms) interact to form networks that produce positive outcomes such as civic engagement and transparency. In the context of digital citizen participation, these tools serve as mediators that align the interests of varied stakeholders (Latour, 2007). For example, digital participatory planning platforms act as non-human actors that facilitate communication between citizens and municipalities (Bouzgenda et al., 2020). By allowing users, in this case citizens, to comment on proposed urban developments or suggest alternatives, these platforms align citizens' desires for involvement with municipal goals of inclusivity and transparency. As Teles and Joia (2010) note, the ability to bring citizens into the planning process via digital tools “creates a shared responsibility for urban development,” thereby enhancing trust and cooperation. Through the process of translation, platforms adapt features to meet both citizen needs (e.g., user-friendly interfaces) and government objectives (e.g., data collection for policymaking).

Another benefit highlighted by ANT is the creation of stable networks that foster trust and accountability. Platforms offering open-access project timelines or live-streamed council meetings enable citizens to monitor municipal actions in real time. These tools build predictability into governance processes, which strengthens public confidence. Yusuf et al. (2016) emphasize that such transparency mechanisms reduce perceived barriers between citizens and government, making participation not only easier but also more rewarding for both parties.

In Scandinavian countries, participatory urban planning tools integrate citizen feedback into infrastructure projects, increasing public satisfaction (Bouzgenda et al., 2020). Similarly, tools like FixMyStreet in the UK bridge gaps between citizens and local authorities by allowing real-time reporting and resolution of local issues, reinforcing transparency and trust (Shin et al., 2024). In Sweden, the platform MinStad allows citizens to contribute to urban planning by marking suggestions on digital maps. This tool increases accessibility and engagement by enabling participation regardless of time or location constraints (Helldén & Zhao, 2020).

The Technology Enactment Framework provides additional insights by focusing on how institutional arrangements shape the adoption and use of digital tools. It emphasizes the distinction between objective technologies (features a tool offers) and enacted technologies (features actually implemented and used) (Fountain, 2004). Accessibility is one key benefit shaped by enacted technologies. For example, platforms designed with features like low-bandwidth support, text-to-speech functionality, and multilingual interfaces allow a wider range of citizens to participate. These features are enacted in municipalities that prioritize inclusivity within their institutional goals (Scott, 2004). On the contrary, municipalities lacking the infrastructure or organizational commitment to enact such features may fail to realize the full potential of these tools (Luna-Reyes & Gil-Garcia, 2011). In Berlin, the

platform meinBerlin provides accessible tools for urban planning feedback, ensuring that underrepresented groups can contribute equally. This inclusivity is a direct result of thoughtful institutional planning and the enactment of accessibility-focused features (Pruin, 2022). The meinBerlin platform serves as a leading example of a one-stop digital participation portal, enabling citizens to actively engage in urban planning and policy-making in Berlin. According to Pruin (2022), the platform's ability to centralize a wide range of participatory processes, such as public consultations, collaborative idea generation, and feedback on urban projects, has significantly streamlined civic engagement. By consolidating these activities into a single portal, meinBerlin reduces the fragmentation often associated with traditional participation methods, making it easier for citizens to locate and contribute to ongoing initiatives. This centralization ensures that input from the public is effectively integrated into decision-making processes, avoiding what Pruin describes as the "silo effect" that can hinder cohesive governance.

Transparency is another significant benefit realized through enacted technologies. Open data platforms, for instance, transform raw information into actionable resources for citizens, such as dashboards tracking public expenditures or policy updates. Bouzgenda et al. (2020) observed that open-access urban planning dashboards “bridge the information gap between government action and public perception,” making decision-making processes more understandable and trustworthy. These enacted technologies depend on institutional readiness, including regulations that mandate open data practices and organizational units dedicated to e-governance (Hasler et al., 2017). Civic engagement is enhanced when municipalities leverage participatory tools that offer real-time feedback mechanisms. Examples include participatory budgeting platforms in U.S. cities, where citizens can allocate municipal funds to local projects. These tools succeed because of organizational structures that support flexibility and

responsiveness, enabling citizens to see tangible outcomes from their participation (Bouzgenda et al., 2020).

ANT and the Technology Enactment Framework complement each other in explaining the benefits of digital citizen participation. While ANT focuses on the relationships and processes that align actors' goals, the Technology Enactment Framework highlights the institutional contexts that determine which benefits are realized. Together, these frameworks reveal that the accessibility, transparency, and engagement offered by digital tools are not inherent but emerge through the interplay of human and non-human actors and the institutional environments in which they operate (Fountain, 2004; Latour, 2007).

Social challenges

While digital citizen participation offers numerous benefits, it also presents significant social challenges that municipalities must address to effectively integrate digital tools into governance. Challenges such as the digital divide, privacy concerns, and limited digital literacy can hinder inclusive participation and exacerbate existing inequalities. Using the Actor-Network Theory (ANT) and the Technology Enactment Framework, this section explores these challenges, emphasizing their complexity and potential solutions.

The digital divide remains one of the most prominent barriers to effective digital citizen participation. This divide refers to unequal access to digital technologies and the internet, often correlating with socioeconomic, geographic, and generational disparities (Kvasny & Keil, 2006). For instance, in their study of U.S. cities, Kvasny and Keil found that lower-income populations frequently lack the resources and infrastructure needed to engage in digital initiatives. Similarly, Fernández-Caballero, Pereira, and Rocha (2022) note that while smart city applications have great potential to enhance participation, they often fail to reach marginalized groups, particularly those with limited access to technology or digital literacy. From an ANT perspective, the digital divide can be understood as a misalignment between

human and non-human actors in the network. For example, when citizens lack access to reliable internet, the network between the citizen and the digital participation platform breaks down, rendering participation inaccessible. Addressing this challenge requires translation processes that adapt digital tools to the needs of diverse populations, such as providing offline options or enhancing public access to technology (Teles & Joia, 2010).

Privacy concerns represent another critical barrier to digital participation. Citizens may hesitate to engage with digital platforms due to fears about how their data will be collected, stored, and used. Cardullo and Kitchin (2019) highlight these issues in their study of smart city initiatives in Dublin, where distrust in government data practices limited citizen engagement. Similarly, Le Blanc (2020) emphasizes that without robust data protection measures, e-participation systems risk alienating users who perceive their privacy to be at risk. The Technology Enactment Framework sheds light on this challenge by examining how institutional arrangements shape the design and adoption of digital tools. Municipalities must enact technologies with strong data protection protocols and transparent privacy policies to build trust among citizens. Solutions such as anonymized data collection or explicit consent mechanisms can help mitigate these concerns (Tejedo-Romero et al., 2022).

Even when digital tools are accessible, limited digital literacy can prevent meaningful participation. Hasler, Chenal, and Soutter (2017) argue that unfamiliarity with digital interfaces or participation processes often excludes certain demographics, such as older adults or those with lower educational attainment. Additionally, Helldén and Zhao (2020) observed that in Gothenburg, Sweden, citizen participation was hindered by a lack of motivation to engage, often stemming from skepticism about whether their input would have a tangible impact. ANT explains these challenges by highlighting the failure of translation processes to align the goals of citizens with those of the municipality. Citizens may perceive participation as overly complex or inconsequential, disrupting the actor-network. Addressing this requires

municipalities to simplify user interfaces, offer digital literacy training, and create visible feedback loops to demonstrate the impact of citizen contributions (Yusuf et al., 2016).

Municipal resistance to change and institutional limitations further complicate the adoption of digital participation tools. Luna-Reyes and Gil-Garcia (2011) note that rigid institutional structures and a lack of interdepartmental collaboration often hinder the successful implementation of e-government initiatives. Pruin (2022) observes that in Germany, platforms like meinBerlin succeeded only when organizational factors such as political support, staff training, and cross-departmental integration were prioritized. The Technology Enactment Framework provides valuable insights here, showing how enacted technologies depend on institutional readiness. Municipalities must develop flexible organizational structures and dedicate resources to e-participation initiatives to overcome resistance and ensure long-term success.

Combining ANT and the Technology Enactment Framework provides a comprehensive lens for understanding these challenges. ANT emphasizes the need for translation processes that align the interests of human and non-human actors, while the Technology Enactment Framework underscores the importance of institutional contexts in shaping the design and adoption of digital tools. Addressing challenges such as the digital divide, privacy concerns, and organizational resistance requires an integrated approach that includes adapting technologies to diverse user needs, building trust through transparent practices, and fostering institutional flexibility.

Current implementation level

Leiden

Leiden has taken significant steps toward embedding digital citizen participation into its governance structures, with a focus on urban planning and development projects, but the city has not fully evolved into using only digital citizen participation, meaning that it uses a hybrid model. The city's participation policy guides its approach, emphasizing inclusivity, transparency, and citizen collaboration to align public projects with community needs. The policy is operationalized through tools such as Go Vocal, which plays a central role in facilitating digital engagement. Go Vocal allows residents to interact with municipal projects by providing feedback, reporting issues, and suggesting ideas for improvement. One notable initiative involved the participation of over 4,450 citizens in shaping urban development plans, as reported by Fillet (2023). Through this platform, citizens can access detailed project information, view interactive maps, and contribute their input in a structured manner. For instance, municipal planners incorporated community insights by inviting residents to comment on proposed designs and highlight areas of concern during redevelopment consultations.

In addition to Go Vocal, Leiden uses other digital tools to enhance transparency. Open-access dashboards and mapping tools provide residents with real-time updates on the status of projects. According to the municipality’s official guidelines on collaboration, these tools aim to “foster trust by making governmental actions visible and understandable” (Gemeente Leiden, 2024). This guide outlines the standards and practices for collaborative engagement, providing structure and clarity to participation processes. It was developed with input from neighborhood associations, experiential experts, and the residents' collective 'Leidse Gesprekken' (Beurse, 2023). Leiden’s participation policy prioritizes accessibility, recognizing that effective engagement requires removing barriers for diverse demographics.

Multilingual support and intuitive interfaces are built into the tools to accommodate non-native speakers and citizens with limited digital literacy. Furthermore, the city promotes digital inclusion by offering workshops and training sessions to help residents familiarize themselves with the platforms. These efforts align with the municipality's goal of ensuring that "every resident has the opportunity to contribute to the city's future" (Gemeente Leiden, 2024). The city's new participation framework is closely tied to the Omgevingswet (Environment and Planning Act), effective from January 1, 2024, which requires municipalities to engage residents at a minimum level of consultation. The new law prioritizes structured engagement, requiring the development of participation plans and follow-up reports to showcase the utilization of community input (De Waard, 2023).

The municipality also collaborates with local organizations to extend the reach of its digital participation efforts. These partnerships enable the city to gather insights from harder-to-reach communities, such as low-income residents or elderly individuals who may not readily engage with digital tools. By fostering these connections, Leiden ensures that its participation initiatives are both inclusive and representative of the broader community.

Despite these advancements, the municipality acknowledges areas for improvement. The participation policy highlights the need for sustained engagement, noting that initial enthusiasm for digital tools can wane over time. As a result, the city is exploring gamification features and incentives to encourage ongoing involvement from residents.

Amstelveen

Amstelveen has positioned digital citizen participation as a cornerstone of its governance, particularly in environmental and urban planning initiatives, but it has not completely let go of conventional citizen participation, meaning that it also uses a hybrid model like Leiden. The municipality's participation policy emphasizes co-creation, wherein residents collaborate directly with municipal officials to shape public projects. This

collaborative approach reflects the city's vision of building a participatory culture that values citizen input as a critical component of decision-making.

Go Vocal serves as the primary digital platform for engaging residents in Amstelveen. The platform enables citizens to provide feedback on urban development projects, report issues, and propose ideas for neighborhood improvements. According to Fillet (2023), Go Vocal has been instrumental in facilitating citizen involvement in sustainability initiatives, such as the development of greener urban spaces. Through this platform, residents have actively contributed to the design of parks, cycling routes, and other public infrastructure, ensuring that projects align with community priorities.

Amstelveen is also actively involving its residents in shaping the city's future, particularly through its initiatives aimed at envisioning Amstelveen in 2040. Programs like 'Denk Mee' ('Think Along') invite citizens to provide input on creating healthy and relaxed living and working environments (Amstelveens Nieuwsblad, 2023). Additionally, the city is updating its integral housing plan for 2024–2040, integrating resident feedback to ensure the plan reflects community aspirations (Amstelveens Nieuwsblad, 2023). Amstelveen has also implemented participatory budgeting tools, allowing residents to vote on how municipal funds are allocated to specific projects. These tools promote transparency and empower citizens to have a direct say in resource allocation. The municipality's policy emphasizes that participatory budgeting not only enhances engagement but also fosters a sense of ownership among residents, as they see tangible outcomes from their contributions (Fillet, 2024).

A unique aspect of Amstelveen's approach is its focus on internal adoption and capacity-building. The municipality has invested heavily in training its employees to use digital participation tools effectively. This internal emphasis ensures that municipal staff are equipped to facilitate meaningful engagement and respond to citizen input promptly. As highlighted by Fillet (2024), this strategy has been critical in building a participatory culture

within the organization, ensuring that digital tools are seamlessly integrated into daily operations. To support inclusivity, Amstelveen's platforms incorporate accessibility features such as multilingual support and simplified navigation. Additionally, the municipality collaborates with community organizations to reach residents who might otherwise miss out on digital participation initiatives. For example, local NGOs and neighborhood associations are involved in promoting awareness of participatory projects and encouraging community involvement.

Amstelveen's participation policy also emphasizes transparency. Digital tools provide residents with detailed information about ongoing projects, including timelines, budgets, and progress updates. By making this information readily available, the municipality seeks to build trust and accountability, ensuring that residents feel confident in the city's governance processes (Gemeente Amstelveen, 2023). However, Amstelveen faces challenges in maintaining long-term participation. The municipality has observed that while initial engagement levels are high, sustaining this momentum requires continuous innovation. To address this, Amstelveen is exploring ways to gamify participation processes and incentivize citizens to remain actively involved in decision-making.

Differences

Leiden and Amstelveen, while both committed to digital citizen participation, operate within distinct contexts that shape their approaches and outcomes. Their differences stem from variations in demographics, governance structures, and the specific applications of digital platforms. Examining these challenges and opportunities in greater detail reveals insights that extend beyond the municipal level to inform broader strategies for effective digital governance.

Demographics and inclusivity

Demographics are essential in determining the problems and opportunities of digital participation in each municipality. Leiden's significant population of students and young professionals makes it suitable for digital engagement efforts (Appendix B). This demographic exhibits elevated digital literacy, hence facilitating the adoption of platforms such as Go Vocal. Nevertheless, whereas youthful and digitally adept inhabitants engage actively, the municipality encounters difficulties in involving senior residents or individuals with restricted digital competencies. The digital divide, while less significant in Leiden compared to other municipalities, nonetheless necessitates targeted outreach to promote inclusivity (Fillet, 2023b). Initiatives such as offering workshops and bilingual resources represent progress, although may necessitate additional enhancement to successfully engage various populations.

The demographic diversity of Amstelveen presents distinct difficulties and opportunities. The municipality must address a diverse array of cultural and linguistic requirements due to the substantial presence of expatriates and families (Appendix C). This diversity enriches the participatory process by introducing diverse perspectives to urban planning talks. Ensuring the inclusion of all groups, especially those with limited Dutch proficiency, necessitates further resources and initiatives. The integration of multilingual alternatives on digital platforms and collaborations with local groups to engage certain communities has proven effective but necessitates ongoing development to systematically address participation gaps (Fillet, 2023a).

Administrative structures and policy implementation

Leiden benefits from a centralized governance structure that allows for smooth decision-making and consistency in implementing participation policies. This structure is apparent in its application of the *Handreiking samenwerken in de stad*, which provides clear

guidelines for involving citizens in urban planning initiatives. The centralized approach ensures that digital participation aligns closely with municipal goals, enabling efficient integration of citizen input into planning processes (Gemeente Leiden, 2024). However, this centralized structure also means that participation efforts rely heavily on municipal oversight, leaving limited room for new initiatives or localized adaptations that might engage smaller communities more effectively.

Amstelveen, with its decentralized governance model, allows for greater flexibility and localized engagement. Neighborhood-based co-creation initiatives encourage citizens to take a more active role in shaping their environments, particularly in projects related to urban greening and sustainability (Fillet, 2023a). However, this flexibility also introduces problems, such as potential inconsistencies in how participation policies are implemented across different neighborhoods. Decentralization requires robust coordination mechanisms to ensure that all initiatives align with central municipal goals and maintain fair standards for engagement.

Digital tools and resource allocation

The performance of digital platforms like Go Vocal varies between the two municipalities due to differences in how the tools are applied and resourced. In Leiden, Go Vocal is primarily used for consultation, emphasizing transparency and feedback in urban planning. The platform allows citizens to comment on development proposals and monitor project progress, fostering trust and accountability. Despite these advantages, resource limitations can hinder the municipality's ability to sustain high levels of engagement. For example, while initial consultations often attract significant participation, maintaining long-term involvement requires continuous investment in user experience improvements and targeted outreach efforts (Fillet, 2023b).

Amstelveen takes a broader approach to platform usage, combining Go Vocal with participatory budgeting and other co-creation tools. This multifaceted strategy creates opportunities for deeper engagement, as residents are not only consulted but also actively collaborate on projects. However, managing these diverse tools places additional demands on municipal staff and resources. Ensuring that employees are effectively trained and that systems are flawlessly integrated requires ongoing effort, particularly as new technologies and methods emerge (Fillet, 2024).

Conclusion

The experiences of Leiden and Amstelveen provide significant insights for municipalities aiming to establish or enhance digital participation initiatives. A key result is the need for customized solutions that align with the unique characteristics of each community. Leiden's centralized methods are advantageous; nevertheless, integrating localized co-creation initiatives similar to those in Amstelveen could improve interaction with underrepresented groups. Amstelveen may use Leiden’s systematic consultation methods to enhance the coherence of its dispersed projects.

Both municipalities emphasize the significance of combining digital and traditional approaches. Although digital technologies improve accessibility and transparency, in-person workshops and co-creation sessions are essential for engaging demographics that may be excluded by strictly digital methods. Hybrid strategies that combine online platforms with physical engagement opportunities will likely result in the most inclusive and successful outcomes.

A key insight is the significance of municipal capability in maintaining digital participation. Amstelveen's emphasis on internal adoption illustrates that investing in

employee training and resources is essential for the effective integration of digital tools into governance. Likewise, Leiden's initiatives to improve openness and diversity illustrate the necessity of consistently modifying platforms to address the changing requirements of the community.

At a broader level, the experiences of these two municipalities offer insights for other cities in the Netherlands and beyond. They demonstrate that successful digital participation depends not only on the tools themselves but also on the governance frameworks and cultural contexts in which they are implemented. Municipalities must be prepared to experiment, adapt, and learn from each other to maximize the potential of digital citizen participation in shaping more inclusive and responsive urban environments.

The primary research question, *"What are the key challenges and benefits associated with implementing digital citizen participation at the municipal level of Leiden and Amstelveen?"*, can now be answered by producing the findings of this study. Both municipalities offer examples of how digital tools can foster inclusivity, transparency, and engagement, while also revealing significant challenges such as the digital divide, privacy concerns, and organizational resistance.

Leiden exemplifies the benefits of centralized processes that enhance consultation efficiency and promote openness via platforms such as Go Vocal. Leiden establishes a systematic and inclusive framework for citizen engagement by integrating participatory activities into urban planning policy and prioritizing accessibility through workshops and multilingual resources. On the other hand, Amstelveen's decentralized strategy, marked by co-creation programs and participatory budgeting, emphasizes the significance of allowing local people to influence their urban environments. This method guarantees the inclusion of varied viewpoints in municipal decision-making, especially concerning sustainability and urban greening initiatives.

Both municipalities have made significant progress, but their experiences underscore the importance of addressing common challenges. The digital divide remains a persistent issue, as access to technology and digital literacy vary across demographics. Privacy concerns and trust issues also hinder participation, particularly when citizens perceive risks associated with data collection and management. Furthermore, organizational limitations, such as resource constraints and staff training gaps, can impede the effective implementation of digital platforms.

Comparative insights

The comparative analysis of Leiden and Amstelveen offers significant insights into the impact of local contexts on the implementation of digital participation. Leiden's centralized governance framework facilitates uniform and efficient procedures, however it may constrain novice innovation. Amstelveen’s decentralized framework promotes localized participation but may result in discrepancies in policy execution. By assimilating each other's methodologies, these towns can enhance their strategies to more effectively meet the requirements of their constituents.

Leiden might implement Amstelveen’s co-creation approaches to enhance engagement with marginalized groups, especially in communities that may feel alienated from centralized decision-making processes. Conversely, Amstelveen might gain from Leiden's systematic consultation techniques to guarantee uniformity and accountability throughout its fragmented efforts. These reciprocal lessons underscore the significance of adaptable government that evolves in accordance with community demands and input.

Hybrid models

Leiden and Amstelveen’s experiences highlight the effectiveness of hybrid models in urban planning and community engagement. For example, Leiden’s workshops complement

its digital platforms by providing citizens with opportunities to ask questions and offer feedback in person. Similarly, Amstelveen's co-creation sessions bring diverse stakeholders together to collaboratively design projects, ensuring that digital platforms are used as tools rather than replacements for human interaction.

Sustaining participation

The success of digital participation initiatives depends on sustained engagement from both citizens and municipal staff. Amstelveen's focus on internal adoption underscores the importance of investing in staff training and resources to ensure the effective use of digital tools. By building a participatory culture within municipal organizations, Amstelveen demonstrates how internal capacity-building can enhance the long-term viability of digital initiatives.

Leiden's emphasis on transparency and inclusivity highlights the importance of continually adapting digital platforms to meet evolving community needs. Features such as multilingual support, intuitive interfaces, and real-time updates are essential for maintaining citizen trust and engagement. However, both municipalities recognize that sustaining participation requires ongoing innovation. Initiatives such as gamification and incentives can help maintain citizen interest and involvement over time.

Broader implications

The results of this study hold significant implications for municipalities beyond Leiden and Amstelveen. They illustrate that effective digital participation requires a comprehensive approach that takes into account technological, institutional, and cultural elements. Municipalities must implement governance frameworks that facilitate experimentation and adaptation, allowing them to derive insights from both successes and failures.

Furthermore, the study underscores the necessity for cooperation and knowledge exchange among municipalities. Through the exchange of best practices and insights, municipalities may collaboratively enhance their digital engagement strategies and tackle shared obstacles. The implementation of participatory budgeting techniques, exemplified by Amstelveen, may motivate other municipalities to investigate analogous methods for improving citizen engagement.

Future research and suggestions

This study contributes to the growing body of literature on digital governance by offering a comparative analysis of two medium-sized Dutch municipalities. Future research could expand on these findings by exploring additional case studies, including municipalities with different governance structures, population sizes, and cultural contexts. Longitudinal studies could also provide insights into how digital participation evolves over time and its long-term impact on citizen engagement and trust.

Practically, the findings suggest several actionable steps for municipalities. Municipalities should design participation initiatives that reflect the unique characteristics of their communities, including demographics, governance structures, and local needs. Combining digital and traditional methods ensures inclusivity and addresses the limitations of

digital-only approaches, so municipalities should invest in hybrid models. Investing in staff training, resources, and internal acceptance is fundamental for the successful integration of digital tools into governance, which will enhance municipal capacity. Clear communication, robust data protection measures, and visible feedback loops are essential for building citizen confidence in digital participation initiatives, so municipalities should prioritize transparency and trust. Furthermore, municipalities should share best practices and collaborate on developing innovative solutions to common challenges, fostering collaboration. By implementing these recommendations, municipalities can create more inclusive, transparent, and effective participation frameworks that empower citizens to shape their urban environments.

In conclusion, the experiences of Leiden and Amstelveen illustrate the transformative potential of digital citizen participation. Their efforts demonstrate that while challenges persist, thoughtful strategies and collaborative governance can maximize the benefits of digital tools. As municipalities continue to experiment and adapt, they will play a key role in shaping more inclusive and responsive citizen participation.

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Appendix A

Coding scheme

Category	Code	Description	Indicators	Example
Digital citizen participation	Digital participatory planning	How digital tools facilitate public involvement in the planning and decision-making process of urban development or policy initiatives.	Number of citizens submitting feedback through online platforms, the variety of planning issues addressed via digital platforms, frequency of virtual town hall meetings or planning sessions.	Online consultations for urban planning, web-based surveys on proposed infrastructure projects, or interactive maps for community feedback on urban development plans.
Digital citizen participation	Accessibility	The extent to which digital platforms are designed to be inclusive and usable by citizens with varying levels of digital literacy, disabilities, or limited internet access.	Presence of user-friendly interfaces, availability of content in multiple languages, accessibility options like text-to-speech, or mobile platform compatibility.	Digital tools that provide options for visually impaired users, multilingual participation platforms, or mobile apps designed to work with low bandwidth connections.
Digital citizen participation	Transparency	How digital platforms improve the visibility of government actions and decisions to the public.	Availability of open data, public records, or live-streamed decision-making processes.	Online access to public contracts, budget data, or real-time policy discussions.
Digital citizen participation	Inclusive participation	How digital tools can lower barriers to citizen participation for a more diverse set of voices in policymaking.	Participation rates from various demographics, rural vs. urban engagement metrics.	Virtual platform for participation with wide geographic and demographic reach.
Digital citizen participation	Civic engagement	How digital platforms encourage citizens to participate in democratic processes, such as advocacy or public discussions.	Rates of digital petition signing or online discussion forum activity.	Online petitions for local government action, or digital forums for public debate on policy issues.

Actor-Network theory	Human-technology interaction	Examines how humans and technological artifacts interact and co-shape each other's roles in a networked environment.	Frequency of human intervention in technological processes, usability challenges faced by users, level of automation or interactivity in tools.	Collaboration platforms where users adjust automated recommendations, or public forums where citizens use AI-based tools to explore policy implications.
Actor-Network theory	Actor-Network formation	The process of establishing connections between diverse actors (human and non-human) in a socio-technical network.	Number of stakeholders involved, diversity of actor types, documented instances of collaboration between humans and technology.	Partnerships formed around smart city projects, with software tools, government entities, and local communities working together.
Actor-Network theory	Agency of technology	The degree to which technology independently influences or mediates interactions within a network.	Instances where technology initiates actions, outcomes driven primarily by technological functions, documented feedback loops influenced by automated systems.	AI tools making policy recommendations or algorithms moderating citizen discussions online.
Actor-Network theory	Translation	The process by which actors align their goals and negotiate meanings to create a stable network.	Changes in stakeholder priorities, levels of alignment achieved among diverse actors, documented compromises or mutual agreements.	Civic tech platforms adapting features based on user input during development phases to meet both citizen and government needs.
Technology Enactment Framework	Technological enactment	How users and institutions interpret and apply technology within their specific contexts.	Variability in technology use across different user groups, documented changes in usage patterns over time.	Local governments modifying e-governance tools to suit rural needs versus urban use cases.
Technology Enactment Framework	Sensemaking of technology	The process by which actors understand and attribute meaning to technology within their operational context.	Feedback loops documenting user comprehension, levels of training provided, revisions based on user misunderstanding.	Community workshops aimed at teaching citizens to navigate online petition platforms effectively.
Technology Enactment Framework	Institutional behavior shaping	The influence of technology on institutional behavior and	Changes in decision timelines, adoption of data-driven policies, new	Use of real-time data dashboards influencing urban planning decisions.

		decision-making processes.	procedures influenced by technological capabilities.	
Technology Enactment Framework	Institutional context	The broader environment of norms, rules, and practices that shape how technology is adopted and enacted	Policies supporting or hindering technology adoption, cultural attitudes toward digital innovation, infrastructure readiness.	Countries with robust broadband access and digital literacy campaigns adopting online participatory tools more rapidly.

Appendix B

Demographics Leiden

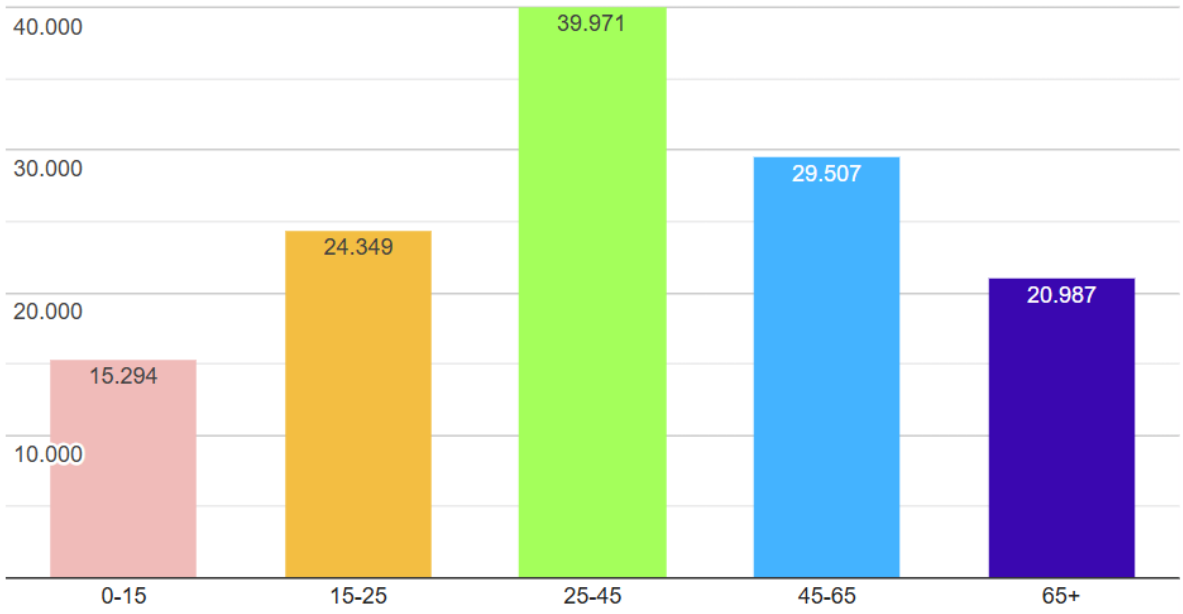

Figure 1: Number of residents on January 1, 2024, by age group.

AlleCijfers.nl. (2025). *Gemeente Leiden in cijfers en grafieken (bijgewerkt 2025!)*

AlleCijfers.nl. https://allecijfers.nl/gemeente/leiden/#leeftijdsgroepen

Appendix C

Demographics Amstelveen

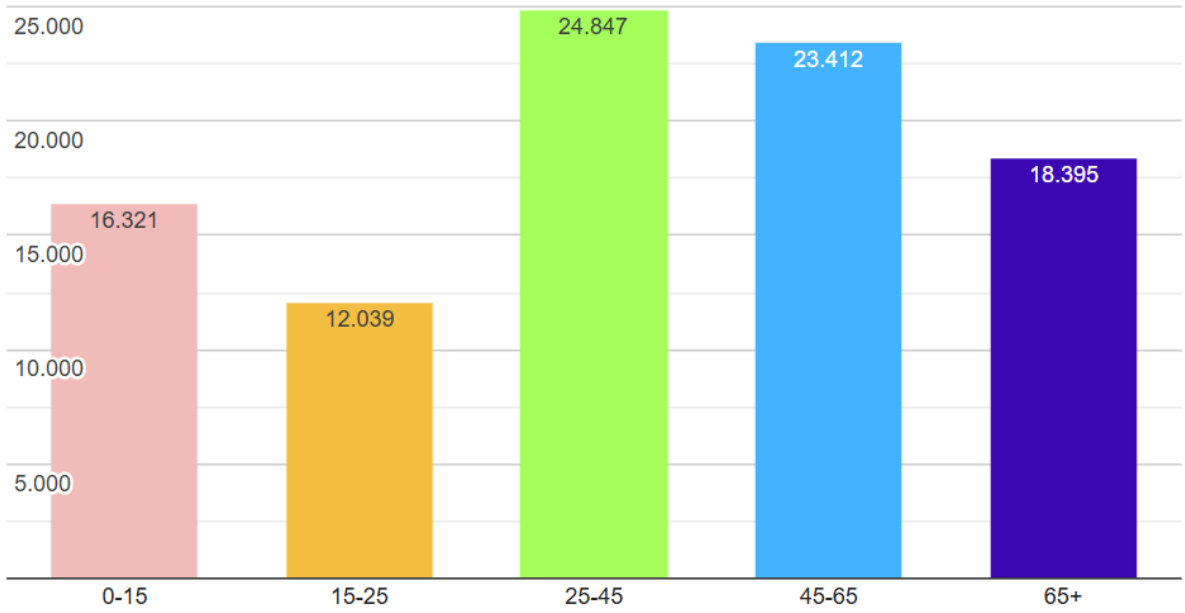

Figure 1: Number of residents on January 1, 2024, by age group.

AlleCijfers.nl. (2025). *Gemeente Amstelveen in cijfers en grafieken (bijgewerkt 2025!)*

AlleCijfers.nl https://allecijfers.nl/gemeente/amstelveen/#leeftijdsgroepen

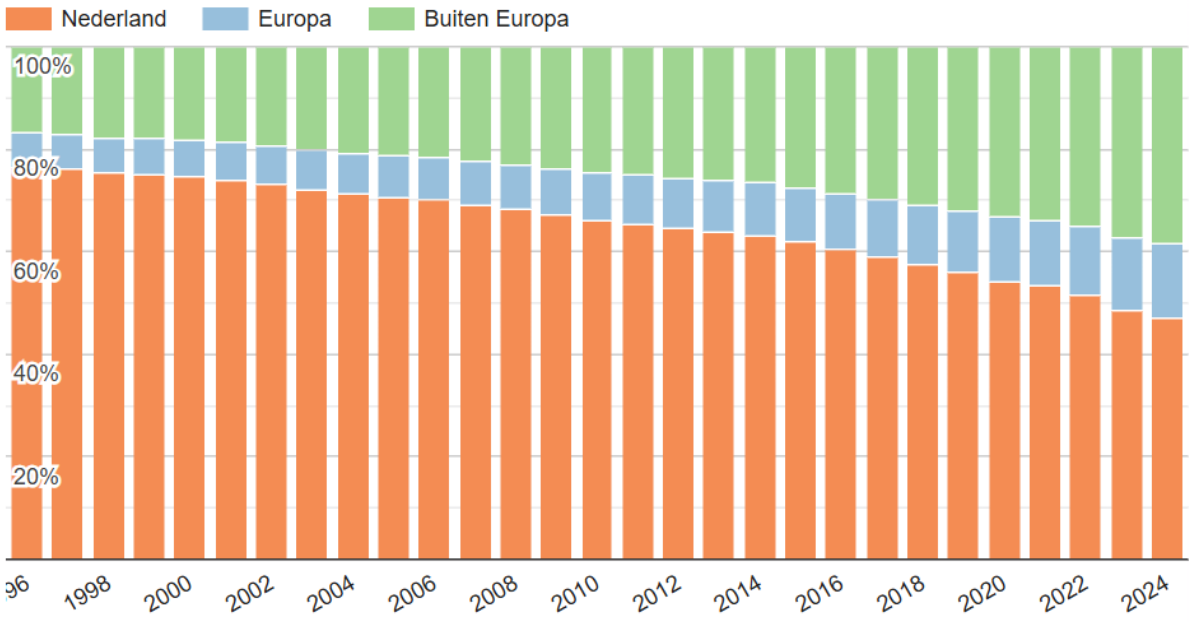

Figure 2: Native or Migration Background in the Netherlands for the period 1996 to 2024.

The above graph shows the distribution of the population by origin: from the Netherlands, from Europe, and from outside Europe, in the municipality of Amstelveen per year. In 2024, the origin of residents in the municipality of Amstelveen was distributed as follows: 47% from the Netherlands, 15% from European countries, and 38% from countries outside Europe.

AlleCijfers.nl. (2025). *Gemeente Amstelveen in cijfers en grafieken (bijgewerkt 2025!)* AlleCijfers.nl https://allecijfers.nl/gemeente/amstelveen/#migratie