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The role of the citizen and participatory data in information model-based planning in Finland

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ABSTRACT

Applying a socio-technical systems approach, this article examines how transitioning to a nationally interoperable land-use planning system affects participatory planning in Finland. We conducted a constructive study, gathering insights from experts in participatory planning, digitalisation specialists, and government representatives through surveys and interviews. Our findings demonstrate that the transformation influences participatory planning. Participatory information is considered an essential component of planning data, highlighting the need for its comprehensive and multidimensional definition and description within the national plan information model. We propose a conceptual model for participatory data and recommendations on how it should be represented in the plan information model.

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Collaborative planning;
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Introduction

The adoption of digital tools in spatial planning has surged due to the emergence of new technologies and policies promoting digitalisation. Government authorities aim to enhance efficiency, innovation, and openness with digitalisation in urban planning. While development-oriented planning research has often highlighted the potential of technology, there is a growing attention to its negative impacts, such as unbalanced power dynamics, exclusion of certain citizen groups, and democratic decline (Potts *et al.*, 2024).

This article investigates a digital planning innovation in Finland, the introduction of a national plan information model (PIM) and the development of a centralised information system (IS) for built environment data (Ryhti) (Finnish Environment Institute FEI, 2024). The article focuses on the impact of Ryhti on democracy in land use planning. The Ryhti IS seeks to streamline the transfer of planning information among various stakeholders and systems, thus enhancing the efficiency of public sector planning. Furthermore, it is argued to increase transparency and improve citizens' opportunities for participation and influence in planning (Ministry of the Environment, 2022).

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Applying sociotechnical systems (STS) theory, which emphasises the interplay between social factors (such as people's needs and values) and technical aspects (such as technical infrastructure and processes where knowledge serves goal-attainment) (Bostrom & Heinen, 1977; Bostrom *et al.*, 2009), our study examines the role of citizens, public participation, and the participatory data (PD) (i.e. information generated by citizens and other stakeholders) in the PIM and Ryhti system. From the perspective of STS theory, social and technical factors must be examined in parallel and with equal weight to understand the impact of technological innovations on people and to create solutions that are technically viable, acceptable for the people and adoptable in practice (Trist & Baforth, 1951; Mumford *et al.*, 1972). A specific problem addressed is the impact of the national plan information model (PIM) on collaborative planning, and the role of participant-generated information in the development of Ryhti.

Background

The digital transformation of land use planning in Finland

The primary goal of the digital transformation of public sector planning is to increase efficiency and transparency of planning and to support innovation (Hersperger *et al.*, 2021). Information model (IM) -based planning is seen as a vehicle for better management of plan information and enhanced public participation (ESPON DIGIPLAN, 2021; Hersperger *et al.*, 2021). In Finland, the objective is to transition to machine-readable and nationally interoperable plan data. The Ryhti IS has been developed to consolidate the municipal and regional plan data into one IS (Finnish Environment Institute FEI, 2024). At the beginning of 2024, new legislation (Act on the Built Environment Information System, 431/2023) was adopted. This act requires municipalities to create land use plans in a nationally interoperable format (i.e. according to the Finnish plan information model, PIM). All new regional and municipal plans (local detailed and master plans) must be stored in Ryhti by the beginning of 2029 at the latest.

Researchers have highlighted the need to examine the role of collaboration and public participation in the digitalisation of the Finnish planning system (Staffans, *et al.*, 2020; Horelli & Wallin, 2023). A planning process rooted in communicative planning theory (e.g. Healey, 2006) involves collaboration and public participation in various forms at different stages of the planning process. Broad public participation opens up the planning process by inviting a variety of perspectives, followed by convergence of knowledge, usually in close collaboration with key stakeholders. A key challenge identified is that the information gathered through public participation is not integrated into the collaborative knowledge building. (Staffans *et al.*, 2020).

IM-based planning is expected to contribute to collaborative planning by enabling better information basis and more inclusive citizen participation. Benefits are expected from developing digital tools such as web-based information sharing and map-based feedback systems (Nummi *et al.*, 2022b). Horelli and Wallin (2023) emphasise that effective public participation requires integrating 'citizens' planning knowledge' with official plan data. Additionally, fostering dialogue between planning data and PD is essential to support diverse perspectives in the planning process (Harsia & Nummi, 2024a).

Public participation in land use planning in Finland

Finnish land-use planning system is a zoning-based system, and can thus be contrasted with development-led, discretionary planning systems typical especially in the UK context (Valtonen *et al.*, 2017; see also Booth, 1996). However, unlike ‘pure’ zoning plans typical especially in the US, Finnish zoning plans include not only zoning regulation but also strategic future visions of the city or site under planning and often also urban design solutions (Mattila, 2021). The planning system is hierarchical, consisting of national land-use guidelines and three levels of plans: regional plans, local master plans and local detailed plans. However, municipalities enjoy a high degree of autonomy in land-use planning (Purkarthofer & Mattila, 2023).

In Finland, the planning legislation sets the minimum level for public participation and interaction in land use planning. Those affected by the plan should be able to participate in planning and in the assessment of the impacts of the plan as well as express their opinions on the plan (Land Use and Building Act (Alueidenkäyttölaki), 132/1999, Sections 62 and 63). In practice, this minimum allows the public to give feedback on plans open to public display, even though the Act suggests a connection between participation and knowledge production in combining participation and impact assessment of plans in the legally mandated ‘Participation and assessment schemes’ (Section 63). However, many municipalities are implementing broader and deeper interaction beyond the requirements of this legislation, for example, by gathering people’s place-based experiential information at the beginning of the planning process (Kahila-Tani, 2015).

In addition, citizens’ self-organised (bottom-up) participation is becoming increasingly important (Mäenpää & Faehnle, 2016, 2021). Moreover, it is notable that the Municipalities Act (410/2015, Section 22) also guides participation, requiring municipalities to support citizens’ independent planning and preparing for public affairs. It has been challenging to apply this regulation in the context of urban planning. However, urban activism is gaining ground and is challenging municipal practices. For example, self-organising citizens are drawing up their own plans, so-called shadow plans (Mäenpää & Faehnle, 2021), or initiating interaction processes linked to urban planning (Harsia & Nummi, 2024a). Indeed, technology has brought new opportunities for citizen-driven planning, such as getting organised through social media (Nummi, 2025) and easy-to-use tools for 3D planning (Nummi *et al.*, 2022a).

Digital tools can support both collaborative and participatory activities in planning processes. Online surveys, discussion platforms and social media enable gathering diverging views from broad public, while interactive city models and easy-to-use modelling tools have been seen to support collaboration. (Staffans *et al.*, 2020) In Finland, the most established digital tools for public participation include online meetings, webinars, municipal feedback channels, social media and online surveys, and traditional online forms and map surveys. The most common purposes for digital participation are gathering local knowledge (e.g. place-based experiences and values) through surveys at the beginning of the planning process and discussing and collecting formal feedback on plan proposals (Nummi *et al.*, 2024).

Currently, PD are seldom systematically used and shared in planning organisations. However, there are examples of place-based experiential information being shared in

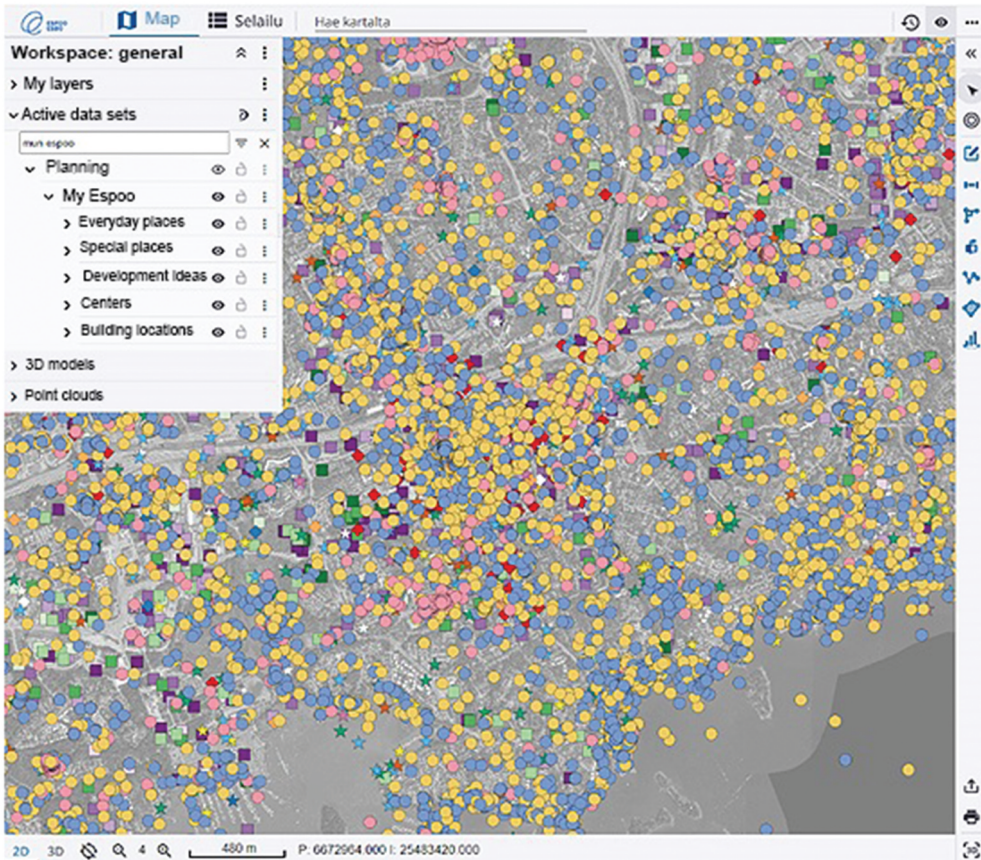


Figure 1. Example of PD in a municipal GIS system. (c) City of Espoo and Trimble Inc (Rossi, 2025).

municipal GIS systems within the organisations (Figure 1) (Rossi, 2025). Furthermore, this information can also be shared as anonymised open data (e.g. My Espoo on the Map survey data (City of Espoo, 2024)) or made visible in online map services or 3d city information models. Indeed, the examples of online map services indicate that municipal plan information systems include participatory information. These data are usually not interoperable with PD gathered or managed with other systems.

It is worth noting that only part of the PD is in GIS format. In fact, with the rise of digital participation, PD has become even more diverse. As participation is increasingly hybrid (combining face-to-face and online interactions) and uses different methods and tools, the data are in various formats, both in digital and analogue modes. Combining and analysing them is laborious (Harsia & Nummi, 2022, 2024b; Nummi *et al.*, 2023).

Heterogeneous PD gathered during the planning process encompasses various types of information, including local knowledge, knowledge of place-based experiences, needs and wishes for development (Figure 2) and feedback on the plan in multiple formats (Figures 3 and 4). Stakeholders can also make their own suggestions and propose planning solutions. New tools are being developed for such self-organised planning activities (Figure 5).

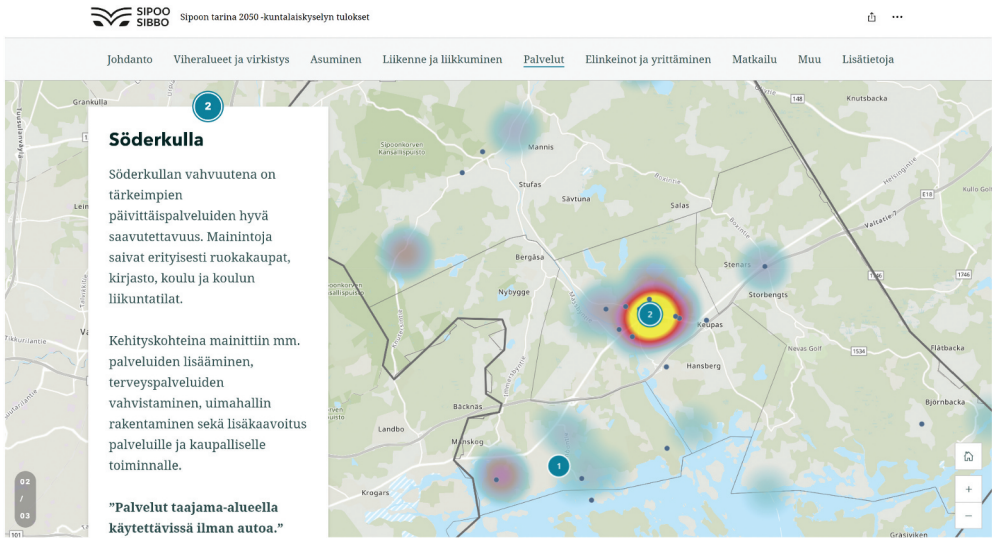


Figure 2. A summary of residents' goals for the development of Sipoo presented on a map. © Municipality of Sipoo and WSP Finland Oy.

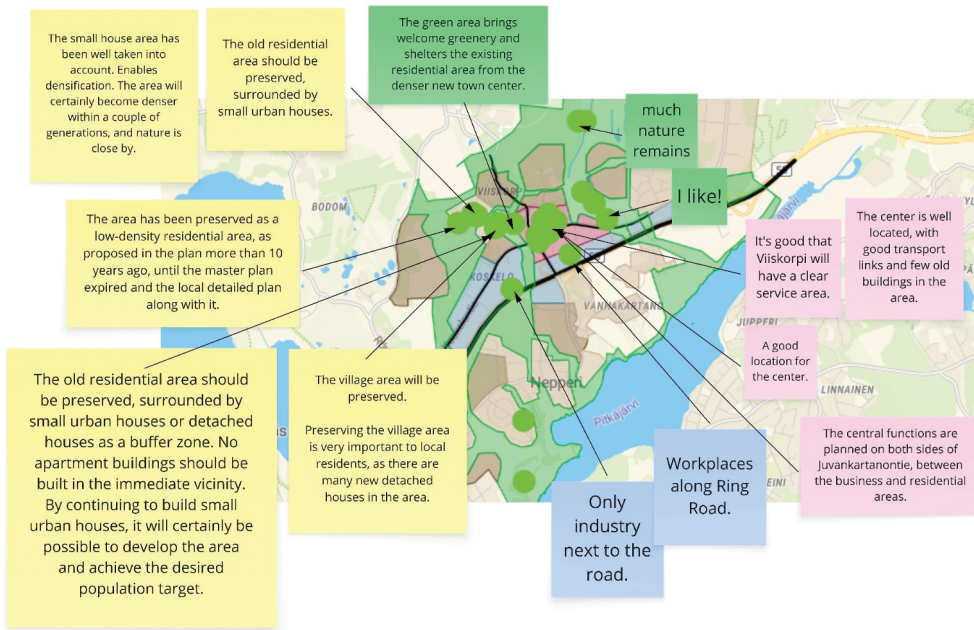


Figure 3. A hybrid participation process produces PD in various formats. In Espoo Viiskorpi, feedback was gathered on the map and on static 3D visualisation (Figure 4) with Maptionnaire (Nummi et al., 2023; Harsia & Nummi, 2024b).



Figure 4. Feedback gathered on static 3D visualisation with Maptionnaire (Nummi *et al.*, 2023; Harsia & Nummi, 2024b). 3D visualisation © Krista Pihlava.



Figure 5. Virtual green planner, a game engine-based 3D tool for self-organised co-planning (Nummi *et al.*, 2022a).

Socio-technical approach to information model-based planning

Socio-technical systems theory (STS) originated in efforts to improve poor working conditions during industrialization (e.g. Trist & Baforth, 1951). Later on, STS has been applied to digitalization in organizations (e.g. Orlikowski, 2000), particularly to IS development (e.g. Mumford *et al.*, 1972; Bostrom & Heinen, 1977). More recently, STS has also been applied to the digitalization of planning (e.g. Nummi & Hapuoja, 2025; Pulkkinen, 2025) and digital public participation methods (e.g. Sieber, 2006; Babelon *et al.*, 2017). These studies share a normative goal: improving technology's acceptability, suitability for human activities, and efficiency of work.

STS emphasises the need to understand and address the interdependency between social and technical aspects when developing IS. The technological aspects include processes, tasks, and technology, while the social aspects cover characteristics of people, including their attitudes, skills, goals, needs and values, as well as relationships between them (Bostrom & Heinen, 1977; Orlikowski, 2000; Bostrom *et al.*, 2009). In addition to identifying and distinguishing the social and technical systems, STS considers the interplay between the systems. Bostrom and Heinen (1977) emphasise that changes in one system can have an impact on other systems. Thus, introducing the new PIM and Ryhti system in Finland may affect the social system, i.e. interaction and participation in planning.

The socio-technical approach gives a relevant starting point for analysing the role of citizens and PD in the Ryhti IS and the national PIM. For our analytical framework (Table 1), we interpret Bostrom and Heinen's framework (1977) in the context of digital participatory planning, and complement it basing on digital participatory planning literature (e.g. socio-technical elements of public participation GIS (Sieber, 2006), a communication-oriented and process-sensitive planning support system (Staffans *et al.*, 2020). Following Sieber (2006) we added culture (e.g. participatory culture) as an additional social factor, and distinguished data (e.g. participatory data and plan data) and outcomes of participatory planning from technology.

Research questions, methods and data

This research aims to understand the role of public participation and participatory information in IM-based planning. The research questions are as follows:

RQ 1: Does the information model-based planning impact public participation in urban planning in the Finnish context? If so, how?

RQ 2: What social and technical factors should be considered if designing and implementing IM-based participatory planning? How do these factors translate to the plan information model?

We approached the research problem with a constructive approach and mixed research methods. First, we explored the viewpoints of the experts in the planning field on the impact of IM-based planning on public participation (RQ 1) using survey data ($n = 123$). This data was gathered in May 2023 as part of a more exhaustive survey related to digital participation (Nummi *et al.*, 2024). Most of the respondents were urban planners ($n = 90$), but also included interaction planners ($n = 14$),

Table 1. Analytical framework developed based on STS theory (Bostrom & Heinen, 1977) and translated to the context of participatory planning.

Social factors	Translation in participatory planning
Actors	Actors refer to various stakeholders and other actors in planning (e.g. citizens, private sector actors, local communities, planners, decision-makers, IT developers, government agency officials, researchers) (Sieber, 2006). Their attitudes, skills and intensity of attention impact on digital participation (Schlossberg & Shuford, 2005).
Interactions	The nature of interaction can be one-way, two-way, multidirectional led by the administration or citizens (Eilola <i>et al.</i> , 2023). Participation and collaboration are two different modes of engagement (Staffans <i>et al.</i> , 2020). Social networks enable and shape interaction (Sieber, 2006).
Structures	Legal structures (e.g., planning legislation, data protection regulations) steer the implementation of participation and impact power relations which empower or disempower individuals (Sieber, 2006). Organisational capacities (e.g. resources and capabilities) affect how knowledge and experiences are shared (Babelon <i>et al.</i> , 2017).
Cultures	Participatory culture (Sieber, 2006) sets the tone for the role of citizens and civil society in planning (Boonstra & Boelens, 2011), and the level of participation (Arnstein, 1969).
Technical factors	
Tasks and processes	The task of the planner is to enable participation and communication in the planning processes, and ensure equality and enable polyphony (Sieber, 2006; Harsia-Mikkola, 2025). Process-sensitive planning emphasizes collaborative knowledge building and the use of methods that meet various interaction and planning information needs at different stages of the planning process (Staffans <i>et al.</i> , 2020).
Technology	The potential of digital technology is harnessed for the benefit of stakeholders. As such, digital solutions should be accessible, usable and useful (Babelon <i>et al.</i> , 2017). Digitalization enables a wide range of participation methods, from consultation to co-development (e.g. Kahila-Tani, 2015), but it also changes planning practices and the entire planning culture (Nummi <i>et al.</i> , 2022b).
Data	Participatory data are part of planning data. Data accessibility is essential for the impact of participation. Openness of the data, privacy protection, and data security are conflicting goals (Sieber, 2006).
Outcomes	Participatory planning generates both material and discursive outcomes (e.g., empowerment, social capacity and inclusion, equity, increased democracy). The consequences can be positive or negative. (Sieber, 2006).

Table 2. Interview sessions and participants.

Interview method (date)	Participants	N
Group interview (8 February 2024) and questionnaire	<i>Planning experts</i> , i.e. experts working in the fields of urban planning, transportation planning, landscape planning, and participatory planning	34
Group interview (21 February 2024 and 23 February 2024) and questionnaire	<i>Researchers</i> in the fields of participatory urban planning, land use and GIS	7
Group interview (3 June 2024)	Information model experts (<i>IM Experts</i>)	2
Individual interviews (August – September 2024)	National-level digital planning experts: <i>Ryhti experts</i> , i.e. experts working for the Ryhti project, <i>state authorities, planning or digitalisation experts</i> working on the national level	9
Total participants		52

managers ($n = 23$), planning assistants ($n = 8$) and other experts ($n = 6$). Additionally, we analysed the documentation of the Finnish PIM (Ministry of the Environment, 2024a) to reveal whether and how participatory information is incorporated in the model.

Second, we conducted a constructive research process, where we iteratively developed a draft extension for the PIM by integrating the information elements of PD into the information model (Figure 6). We asked planning experts and researchers to reflect on this model in group interviews ($N = 43$) and experts of the digitalisation of land use

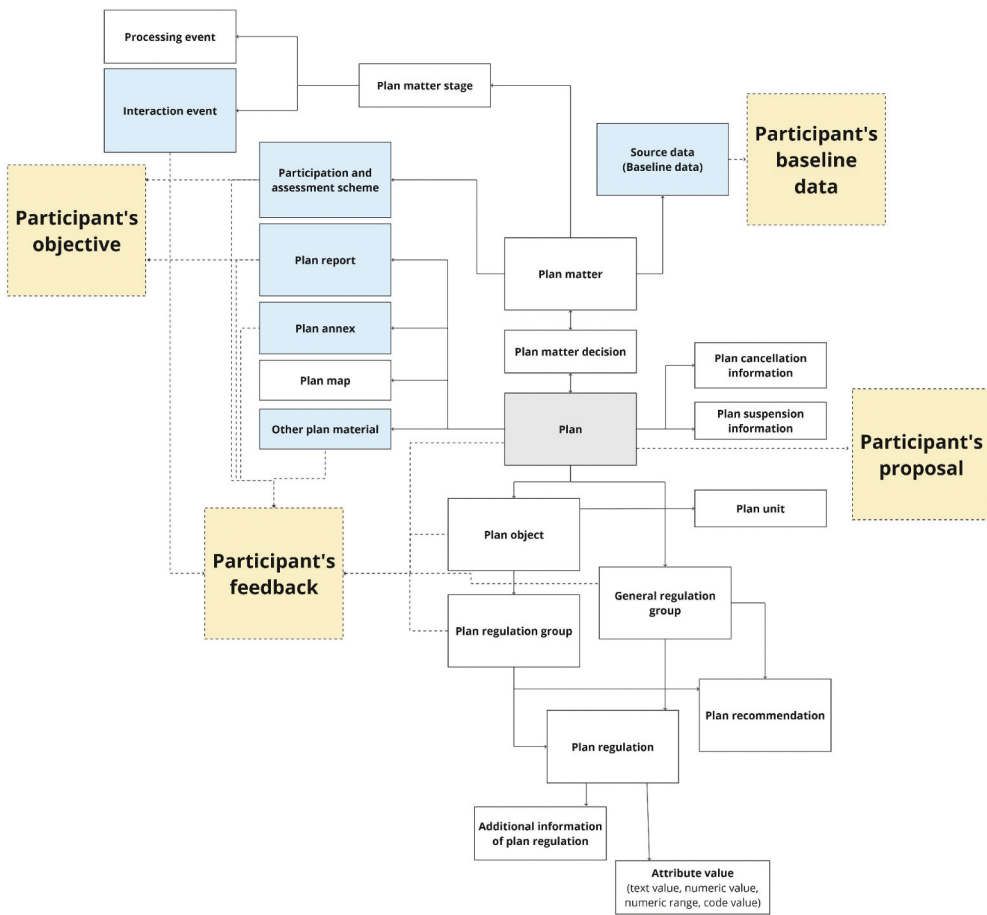


Figure 6. The conceptual model in which the elements of PD are described as part of the national PIM. Authors' illustration, developed based on the Ministry of the Environment (2024a).

planning and Ryhti IS in individual interviews ($N = 9$) (Table 2). In the group interviews, the interviewees' viewpoints were gathered individually with a questionnaire.

The research data gathered in the interview sessions (i.e. questionnaire data from group interviews and transcribed interviews) were analysed using qualitative content analysis method with the help of Atlas.ti software, utilizing the analytical framework we developed based on the STS.

Results

The (expected) impact of IM-based planning on public participation

One of the objectives of the Ryhti project is to promote public participation by improving access to information and the comprehensibility of planning. The goal is to provide citizens with equal participation opportunities across the country. However, Ryhti will not provide tools for public participation, but a platform to build new services and tools. The interviewed representatives of state

administration were optimistic that Ryhti will promote participation by providing access to high-quality and up-to-date plan information. For example, Ryhti could enable notification services to keep local citizens updated on planning projects and participation opportunities. One interviewee emphasised that enhancing public participation has been a political goal for the Ryhti system throughout its development.

In our survey, a large part of the respondents (44%, $N = 123$) believed that IM-based planning has an impact on participation. A quarter of the respondents (24%, $N = 123$) expected public participation to improve. Improvements were seen in the accessibility, accuracy and comprehensibility of information (both plans and their impacts) and the opportunities for participation. IM-based planning was expected to ease participation and enable the emergence of new and more diverse digital participation tools. Some also held that organising participation will become easier for the municipalities. Furthermore, harmonising practices and narrowing the gap between the administration and the participants were mentioned as possible positive effects.

However, the survey respondents did not believe the impacts to be only positive. Concerns, such as poor accessibility and human-readability of plans, were raised by nine respondents. The excessive precision of the information and the general difficulty in using IM-based plans for some participant groups were also mentioned. One planning expert stated that, '[IM-based planning] Hampers participation. People need to be able to express themselves in their natural way.'

A few respondents ($n = 4$) mentioned participatory information in their responses. They indicated that integrating PD into PIM could enhance information gathering, processing, and communication. One planning expert stated that, 'The gathered place-based responses can be well entered in the information model.' Another mentioned that this integration could improve the processing and accessibility of PD for future planners, ensuring that existing data is not lost, and one hoped that PD would become more visible in the planning process.

Social factors

Actors, their roles and attitudes

Planners have a key role in processing and making PD visible. They act as gatekeepers: they process the data, decide what information is relevant and how it will be used in planning, and report on how stakeholders' perspectives have been considered in planning. As gatekeepers, they also have the power and responsibility to use the information fairly. Indeed, the interviewed planners held themselves responsible for balancing different perspectives.

Well, if there are no gatekeepers, then of course the voice of the citizens will be better heard in some way, but how will the relevance be determined? Can all voices be equally heard?
(interview, planning expert)

Both the state authorities and some planning experts stressed the importance of the planners' attitudes on public participation and how the role of local people and the information they provide is perceived in planning. Indeed, attitudes are relevant as there is no explicit legal obligation to make use of the information supplied by participants in

the planning process, only to process and consider opinions and remarks expressed during the planning process.

It depends on the attitude with which you approach the planning process. Planning can be done without participatory information. (group interview, planning expert)

Interviewees also highlighted the role of decision-makers. One interviewee noted that the comprehensibility of PD influences how decision-makers use data in decision-making:

At least within a municipality, if you could bring the views of stakeholders into the plan [in municipal IS], it would help to bring the stakeholders' perspectives to the attention of policymakers. If participatory information is difficult for decision-makers to understand, it is less relevant for decision-making. (interview, state authority)

Our document analysis revealed that the only actors in the PIM are the operator (i.e. the person responsible for the plan matter in their official position) and the decision-maker (i.e. municipal organ). This confirms previous research findings by Horelli and Wallin (2023) suspecting that the new Ryhti IS considers only public sector actors (i.e., municipalities, regional councils, and state authorities) as data producers, excluding citizens and private sector actors.

Contrary to the current PIM, in the early phases of the development of IM-based planning, citizens have been identified both as users of planning information and as active participants and influencers in planning. Furthermore, the information they provide for planning has been considered valuable and essential to integrate into IM-based planning (e.g., Ministry of the Environment, 2019; Ministry of the Environment, 2020b). The interviews revealed, however, that in the ongoing development of Ryhti, the role of the citizen is more limited than in these earlier visions. The need for public participation among citizens is now being promoted by improving access to planning information, whereas the reform does not seem to bring direct improvements in the gathering, processing or impact of the information produced by the citizens. The interviewees stress that Ryhti is a platform for developing new participation-enhancing services. The expectation is that private sector software development companies will develop new participation tools compatible with Ryhti.

Indeed, citizen groups are considered more as receivers of plan information than producers of knowledge. The interviewees highlighted various groups of people who could benefit from digital plan information, such as disabled persons whose needs can be better met by developing accessible participation tools, and the generation of digital natives who may be more at home with digital tools than with face-to-face interaction.

Interaction in planning

The experts of national-level digital planning all emphasised democracy and the importance of public participation in planning. The interaction between planners and citizens, but also among citizens and between citizens and decision-makers, was seen as essential:

Someone's idea can inspire you to come up with another idea. It's also good to know what others think. And there are also initiatives where names are collected, and conflicts can escalate. (interview, digitalisation expert)

Some of the planning experts explicitly mention interaction as an essential part of planning:

Stakeholders are the best experts of their environment, so we need to have good interaction.
The planner is interested in how, for example, residents want their environment to develop.
(group interview, planning expert)

The planning experts highlighted several ways of interacting with stakeholders during the planning process: dialogue at public meetings and workshops, oral discussions and gathering stakeholders' views through electronic tools such as questionnaires. Furthermore, state authorities noted that interaction events and verbal communication between planners and citizens are still crucial, while digital tools are emphasised. The Ryhti experts called for developing and diversifying digital tools for various use cases for target groups.

Interviewees stressed the importance of timely and early participation, which provides local experiential knowledge to inform planning. However, interaction is also considered necessary in the decision-making stages.

As planners, we know that the earlier the stage, the more influence. It would be critical to have tacit knowledge accumulating somewhere. (interview, state authority)

Structures

Obstacles for the inclusion of PD in Ryhti were identified in the Finnish planning legislation. Firstly, participatory information is not properly defined in the planning legislation. The legislation recognises stakeholders' opinions, remarks, appeals, and, to some extent, information collected from or provided by stakeholders that can be used as input for planning, but for example, proposals made by stakeholders are not mentioned in the legislation.

Secondly, the law stipulates the minimum for the information that municipalities are required to store in Ryhti. Furthermore, based on our document analysis, municipalities may, at their discretion, also submit additional documents that can be stored in the PIM. This includes for example, opinions and remarks to the plan. However, the law does not mandate the state administration to require the storing of such information in Ryhti. Based on the interviews, the parties responsible for safeguarding the interests of municipalities have insisted that the Ryhti system should impose as few new obligations on municipalities as possible.

A state authority described the role of legislation as a hindering structure:

The Ryhti system may only store information that has a law-based justification. The legal basis for participatory data is so vaguely defined that it is not possible to say what this data are. (interview, state authority)

Finally, the Data Protection Regulation, for its part, sets requirements for privacy protection. The municipality is responsible for ensuring that the information entered into the system complies with the various legal requirements.

Cultures

The interviewees described Finnish planning culture in various terms. Those who were concerned with the national level had experienced a cultural shift towards a truly

interactive approach over the past decades. The interviewees generally hoped for even deeper interaction in which participants are not merely opinion providers.

The level of participation and the role of citizens emerged as factors in participatory planning culture. Many interviewees would like a change in the planning culture towards co-creation and people becoming more active and empowered in developing their living environment.

The emphasis seems to have been on participants providing opinions rather than the information on which the plans are based. A vision for the future: not only that planners come up with plans and stakeholders give their opinions, but also that at an early-stage stakeholders provide information that is considered in the planning process . . . (interview, state authority)

Digitalisation was also identified as a factor in shaping culture. Digital participation was recognised as an opportunity to broaden the range of participants and to serve residents, especially in large cities.

Technical factors

Tasks and processes in participatory planning

Since the Ryhti system serves the formal planning process, this research focuses on how PD is used in statutory planning. According to the interviews, the task for which Ryhti could be helpful was the collection and processing of feedback on the plans, including responding to feedback. In practice, the planner is responsible for processing this feedback and drafting responses. Still, political decision-makers act as sensors in the process, approving the final responses to the feedback.

Researchers highlighted the need to explore the role and impact of PD in the long term. One researcher mentioned that even if planners base their planning decisions on participatory information, other city officials may undermine the value of PD during the process and change the decisions accordingly.

The planners and state authorities were concerned with the possible increase in planners' workload if PD were integrated into digital plan information more systematically. This increase would be due to the need for moderation and, data management challenges ('clutter' and data privacy issues). Some researchers identified also need for moderation (e.g. removing inappropriate or personal information), but did not see this as a problem.

Technology: Ryhti IS and plan information model

The state authorities and Ryhti experts insisted that Ryhti will not provide public participation tools but a platform and data source to build on. Indeed, through Ryhti application programming interfaces (APIs), up-to-date plan data will be available to use in other digital tools, and it will enable the development of, for example, a notification system for informing about participatory events. The interviewees and some survey respondents were expecting new digital tools to facilitate public participation. However, as mentioned, the national level experts observed structural and practical obstacles in integrating PD in Ryhti.

Based on our document analysis, the current version of the PIM (Ministry of the Environment, 2024a) includes the following information elements related to PD: Participation and Assessment Scheme (PDF document), Plan Report (PDF document), Other Plan Material (e.g. illustrative material, such as videos), Source Data (e.g. baseline data as GIS data, databases) and Interaction Event (e.g. dates for public consultation and events, digital participation). In other words, PD can be linked to the IM-based plan data as separate files, such as PDF documents and GIS data sets saved in a file format, but there is no semantic connection between the content of the PD and the plan (only type of the document) nor a link between PD and the objects or regulations of the plan.

In practice, the plan usually includes PD as summaries in memos or part of the plan report. However, some planners in our group interviews pointed out that in their municipalities, it is common practice to publish stakeholders' opinions in their original form (with personal data removed). Sometimes these opinions are translated into GIS format, even linked to the plan objects in the IM-based plan data. The practices of the municipalities thus differ from the solution of the national PIM. In other words, the IMs of the municipal ISs are more extensive than the Ryhti PIM and may contain genuine original PD also in machine-readable format.

Data: Participatory data in IM-based planning

Based on the document analysis, the role of PD has been central in the earlier visions of digitalisation of land use planning in the late 2010 s in Finland. For example, a vision was created of a continuously up-to-date plan database and a user interface to discuss plans and planning solutions at all process stages, from the initiation of planning to the proposal stage. Access to PD throughout the plan process and linking feedback to plan content was considered essential (Ministry of the Environment, 2019). PD was seen as part of the built environment data, and it was proposed to be defined in the national vocabulary of the built environment (Ministry of the Environment, 2020b).

In the group interviews, the planning experts ($N = 27$) mentioned different types of PD, baseline information and wishes, feedback on plans, ideas and suggestions. Most commonly, planners identify the need for local knowledge, describing the characteristics or use of the planning area from the perspective of its inhabitants and users and information on the area's history. They described such information as baseline information needed at an early stage of planning. They also highlight the need to understand residents' wishes and to gather the opinions of 'silent groups', which are inactive in planning processes.

Researchers ($N = 7$) described participatory information in more general terms than experts. They generally emphasised the importance of place-based empirical knowledge in planning and research. They highlighted the diversity of methods for collecting PD, mentioning workshops, milestones, sticky notes, surveys, etc., with reference to public participation GIS (PPGIS) data.

Slightly more than half of the planning experts ($N = 27$) favoured adding at least one type of PD to the PIM. The most popular kind of PD was feedback on the plans (48%, $N = 27$), but some also wished baseline data (30%) and participant proposals (26%) to be included in the PIM. Some respondents did not find it necessary to include any information (22%), while others did not know how to answer (22%).

Those planners who supported the integration of PD to the PIM justify their views by transparency, building trust, and the mandatory nature of public participation. The following quotes illustrate the various arguments for including PD in a plan information model:

‘Transparency of information builds trust in the public sector.’ (group interview questionnaire, planning expert)

It is important to see how the plan has been consulted and how the plans reflect residents’ views. Transparency is important. But you have to be careful that no personal information leaks into the public data. (group interview questionnaire, planning expert)

Participation is mandated by law, so it generates information that should be relevant and therefore part of the plan information model. (group interview questionnaire, planning expert)

Planners had mixed views on whether PD should be included (or published) unmodified or whether moderation is needed. Those who see moderation as necessary believe that planners’ duty is to moderate the content. The additional work that moderation creates for the planner is considered problematic. Moderation is justified by the need to protect participants’ privacy (i.e. excluding personal information) and to remove inappropriate or irrelevant comments. Although many believe that someone should be responsible for moderation, some argue that participants should take responsibility for their own comments, or that moderation should be done automatically within the IS. The need for moderation is considered from the perspectives of relevance and openness of PD. For example, the following comment illustrates the value of transparency:

If participatory data is irrelevant, then there is no point in putting it there. On the other hand, from the point of view of transparency, it might be good to have all information available for viewing, without being selected by someone else. (group interview questionnaire, planning expert)

On the other hand, one respondent considered moderation of PD as problematic in terms of power relations:

If included, it would increase the transparency of the preparation. The interaction reports are quite an exercise of power in summarising participatory information. If not included, this information in particular would remain obscured. (group interview questionnaire, planning expert)

Some of the respondents considered that it is sufficient to follow the current practices and attach the participation report and responses to the feedback prepared by the planner to the IM-based plan as attachments:

A large part of the feedback is such that the planner can write a response to it. The feedback is usually compiled as an annex to the plan report and is therefore part of the plan documentation. The feedback is also usually summarised to the essentials; I see no reason to include the original feedback separately from the response report/corresponding document. (group interview questionnaire, planning expert)

All interviewed researchers ($N = 7$) agreed that PD should be added to the national PIM. They also thought that PD should be made publicly available, but are uncertain whether the Ryhti system is the right place for this information. It was still unclear how the Ryhti system will be used, and some of the respondents with a researcher role felt that it may

not be meaningful or necessary to publish PD there. One of the researchers pointed out that the survey did not take into account the option of making PD available only to public authorities in Ryhti:

I don't know whether a national system is the right solution or a local one would be better. If Ryhti becomes a system actively used by the municipalities, then participatory data will also fit in. (group interview questionnaire, researcher)

The interviewed researchers pointed out that municipalities are already interested in publishing PD. In some cases, they are already publicly available, for example, through a national participation platform (otakantaa.fi). Inadequate systems and resources were seen as barriers to publishing information.

Some interviewed researchers thought that participatory information would be better taken into account in planning if incorporated into the plan through the IM. This could also contribute to better justification of planning solutions, and foster openness, transparency, inclusion and longer-term use and storage of information. Some interviewed planners felt, though, that structuring PD in the IM format is unnecessary and too rigid.

One researcher pointed out that some harmonisation should be required to integrate PD into the PIM, and takes issue with IM limiting the diversity of the PD:

This might require the creation of recommendations on the appropriate data types and formats for the system, which would not only harmonise the use and comparison of data but could also guide the participatory processes. (group interview questionnaire, researcher)

Some informants were concerned about the usability of PD, suspecting that the data might eventually become so large that it would be difficult to use:

If it is possible to find 'uncensored' feedback, it can improve this relationship [the relationship between direct and representative democracy]. But on the other hand, it may be that no one has the time to analyse. It gets lost in the volume of data. Or even if you had the original data in such a system, you also have a summary of it, and it is then up to your keenness to decide what you want to view. (interview, planning expert)

Discussion

Currently, digital PD exists in various formats, with some being closed off to planning organizations and others available through municipalities or as open data. Challenges in processing and utilising PD in planning indicate the need for a more systematic approach to its use (see e.g. Rossi, 2025). Our research indicates that explicitly defining and integrating PD into the national PIM could contribute to a more systematic use of the data.

As in some other countries (see e.g. Fertner *et al.*, 2019; Hersperger *et al.*, 2021), the digitalisation of land use planning in Finland focuses on data management and standardisation of formal plan data. Our socio-technical analysis reveals that this may exclude citizens' contributions to planning information. Furthermore, practical and structural factors currently limit broader integration of PD in PIM and the Ryhti IS. However, most of our interviewees favour the proposal to extend the PIM to cover participatory information.

The underlying structural challenge in integrating PD into the PIM is the lack of a formal definition of PD. Participatory information is not defined in law or in the Terminology of Built Environment (a Finnish collection of terms and their definitions in the field of built

environment (Ministry of the Environment, 2024b)) used in information models. More explicitly, the planning law only mentions opinions on the participation and assessment scheme and the plan draft and remarks on the plan proposal. Thus, other types of participatory information cannot be accurately referenced in the IM-based plan data.

The ongoing reform of the Finnish planning law introduces necessary information, broadly referring to up-to-date information accumulated and acquired during and prior to planning purposes based on research, studies, and information and material collected from stakeholders through interaction procedures (Ministry of the Environment, 2025). However, the proposed amendment does not explicitly require using participatory information. Presenting different forms of PD in the information model could fill legislative gaps and concretise PD's relevance as necessary plan information.

Since municipalities have a monopoly on land-use planning, municipal ISs are the central repositories for plan data. Plans are prepared in municipal ISs, which can (and often do) contain more information about plans than the Ryhti system. Many interviewees considered that the place of PD is in the municipal ISs, not in the Ryhti system. Moreover, the central government think there is no mandate to require PD be introduced into the Ryhti IS, as this is not stipulated in law.

The role of the Ryhti IS as an 'enabling platform' is therefore limited, as it cannot promote collaboration between municipalities (e.g. regional planning) in public participation, as PD is not imported into the system. For example, separate databases would be needed to share PD for inter-municipal planning collaboration.

A conceptual model for participatory data

A conceptual definition is necessary to explicitly discuss PD in the future, refer to it in legislation, and systematically handle digital PD collected through different software. Based on the results from our constructive research process and analysis of the interview data, we propose that the conceptual information model of participatory information (Figure 7) would include four types of PD: 1) Participant's Objective, 2) Participant's Baseline Information, 3) Participant's Proposal, and 4) Participant's Feedback. Furthermore, the Participant's Feedback would be connected to the Response to Participant's Feedback. Additionally, our results suggest that the IM should include the individual actors or actor groups who generate or interact with PD. These are individual participants (e.g. residents or citizens as individuals) or collective participants (e.g. NGOs, local communities), decision-makers, and planners.

The extension of the PIM with the concepts of PD does not necessarily mean that the data will be published in the Ryhti system. However, the definition of PD in the PIM would legitimise the concept and types of PD, guide the development of planning software, and provide an opportunity to harmonise practices for collecting, processing, and using PD in municipalities. Alternatively, PD could be described in a separate information model.

Participant's objective

Objectives are identified from participants' input at the beginning of or during the planning process. Planning objectives can also stem from other planning and interaction

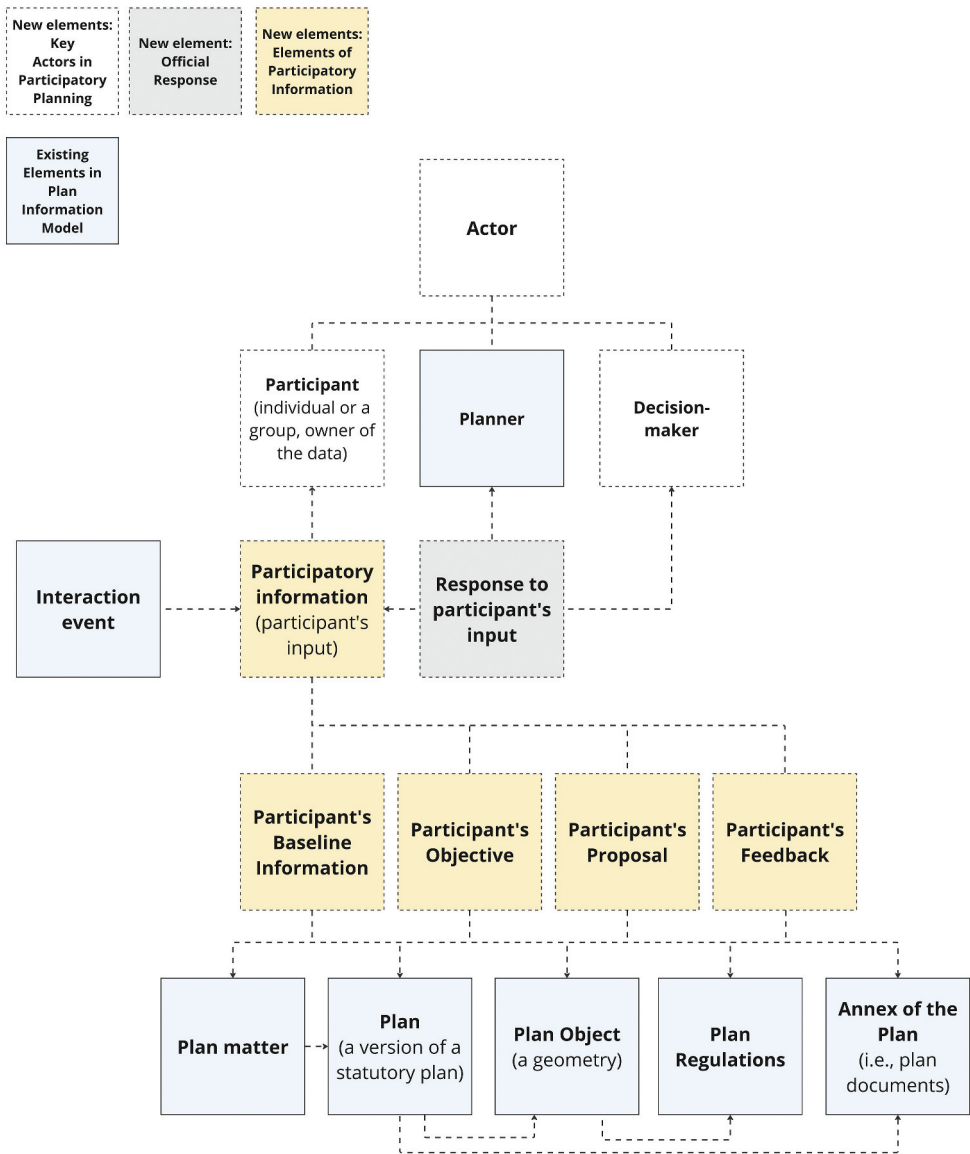


Figure 7. Our draft of a conceptual model for participatory information in statutory land use planning. The chart includes suggested new actors (white) and elements of participatory information (light yellow) and official response (light grey), and key existing elements of plan information (light blue), and the connections between them.

processes, such as vision or framework plans (e.g. co-created visions). A participant’s objective can be based on a stated need or interpreted by the planner from feedback. It is important to identify the actor(s) associated with each objective when possible.

Participant's baseline information

Participant Baseline Information includes local knowledge (e.g. human activities, area history), experiential knowledge (e.g. perceived environmental quality), or participant observations. This information can be collected through tools like PPGIS or traditional online surveys, typically at the start of the planning process. It serves as a dataset or specific information used in planning. While PIM allows such datasets to be separate files in IM-based plans, it is important to define this concept separately for the sake of legitimacy of participatory planning. Additionally, the relevance of this information may extend beyond the plan in question to other planning projects.

Participant's proposal

The results indicate a desire for more active participation and engagement in planning people's living environments. Proposals are crucial for self-organising participation in Finland but have not been effectively integrated into planning culture (Wallin, 2019; Mäenpää & Faehnle, 2021). Finnish Municipalities Act (410/2015, Section 22) encourages residents' and NGOs' initiatives. Linking Participants' Proposals to the PIM would foster the recognition of shadow plans and bottom-up initiatives in the planning process.

Participants' Proposals can outline alternative planning solutions or ideas and take the form of maps, 3D models, or written/visual submissions. While the current PIM and Ryhti support various plan versions, most participants lack the tools to create detailed plans according to the PIM. Thus, the Participant's Proposal should accommodate various input formats, including plain text and sketches.

Participant's feedback for the plan and planner's response to participant's feedback

Participant's Feedback is an opinion on the plan, which can be expressed in text, visual material, or other formats. Its status in the planning process should not depend on whether it is a 'formal opinion' or an informal remark.

Feedback may address the overall plan, specific plan objects, provisions, recommendations, or related plans (e.g. street plans, a higher or lower level plan). The feedback must be semantically related to the version of the plan or part of the plan for which it is provided, as well as other plans it may refer to. Thus, Participant's Feedback may (but does not have to) refer to a specified location in the plan.

Interaction event's connection to participatory data

PD can be linked to an interaction event if it is collected in an event. Linking PD to an interaction event supports the management and retrieval of the information. In the PIM, an interaction event is broadly defined as an opportunity for stakeholders to express views and provide feedback on a prepared plan or regulation (Ministry of the Environment, 2020a).

New actor: participant

Citizens have been neglected in the digitalisation of built environment in Finland, although they produce relevant information for urban planning (Horelli & Wallin, 2023). Our research supports the inclusion of local knowledge producers in digital planning systems.

We propose adding a new Actor, a Participant, to the PIM to acknowledge citizen-generated information and validate their role in co-producing planning data.

Limitations of the study

STS has mainly been applied within organizations in the development of technology and has been found to be appropriate in situations where stakeholders can be defined and identified, and thus social factors can be accurately diagnosed (e.g. Mumford *et al.*, 1972; Bostrom & Heinen, 1977; Orlikowski, 2000). Participatory planning brings the entire societal context to the discussion, including various citizen groups, with notable complexity which cannot be fully described or understood. In this study, we examined IM-based planning and the role of PD from the perspective of planning experts and state authorities, so essential social issues (e.g. the needs and values of different citizen groups) remain outside the scope of this study. The conceptual model developed does not take a stand towards all aspects of the content of PD, nor does it solve all the challenges related to processing PD. This study focused on defining participatory information in such a way that it can be incorporated into IM-based planning in a more comprehensive manner than is currently the case. As noted before (see e.g. Hersperger *et al.*, 2021), the IM format brings with it limitations, as it forces to simplify the information. Thus, the categorization of information simplifies the diversity of PD and it is possible that the model presented in this article does not cover all types of PD, and should therefore be tested and supplemented in further research.

Conclusions

In this research, we analysed the impact of IM-based planning on public participation in Finland, focusing on socio-technical factors. We interviewed planning experts, researchers, state authorities, and experts of the national PIM and Ryhti IS, and we assessed our suggestion for an extension to the PIM ('participatory PIM') with them. Based on the results of this constructive research, we created a further developed version of the participatory PIM.

Our results indicate that IM-based planning affects public participation positively or negatively. Opinions on incorporating participatory information into the Ryhti IS vary, with feedback on plans deemed the most essential type of PD in planning processes. Furthermore, the results indicate a need to incorporate PD into the PIM for interoperable application of PD within municipal ISs.

A significant structural barrier to integrating PD into Ryhti is the lack of relevant concepts in planning legislation. To address this, we propose a conceptual model incorporating four new information elements into the PIM: Participant's Baseline Information, Objective, Feedback, and Proposal. This could enhance the interoperability of digital interaction tools, planning software, and municipal ISs and thus support the systematic use and impact of PD in urban planning.

Based on our results, the social aspects of digital planning have been overshadowed by the technical dimensions in the recent Ryhti development. While valuing democracy and citizen engagement, many expressed concerns about the increased workload for planners that could result from integrating such information, revealing a tension between

democratic ideals and digital solutions. In order to avoid technocratic development in digitalization, it is important to identify and highlight the value choices associated with solutions.

We argue that in the development of Ryhti, technology could also be better harnessed to create solutions that promote democracy, polyphony and inclusiveness in urban planning. Technology should be applied to overcome the practical challenges (i.e. the need for manual or additional work in municipalities), e.g. by automating the anonymisation and moderation of PD. In this way, interoperable integration of PD into planning information systems would be feasible in the long term.

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