
This is an electronic reprint of the original article.
This reprint may differ from the original in pagination and typographic detail.

Nurminen, Valteri; Rossi, Saana; Rinne, Tiina; Kyttä, Marketta

How has digital participatory mapping influenced urban planning : Views from nine planning cases from Finland

Published in:
Computers, Environment and Urban Systems

DOI:
[10.1016/j.compenvurbsys.2024.102152](https://doi.org/10.1016/j.compenvurbsys.2024.102152)

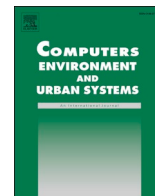
Published: 01/09/2024

Document Version
Publisher's PDF, also known as Version of record

Published under the following license:
CC BY

Please cite the original version:
Nurminen, V., Rossi, S., Rinne, T., & Kyttä, M. (2024). How has digital participatory mapping influenced urban planning : Views from nine planning cases from Finland. *Computers, Environment and Urban Systems*, 112, Article 102152. <https://doi.org/10.1016/j.compenvurbsys.2024.102152>

This material is protected by copyright and other intellectual property rights, and duplication or sale of all or part of any of the repository collections is not permitted, except that material may be duplicated by you for your research use or educational purposes in electronic or print form. You must obtain permission for any other use. Electronic or print copies may not be offered, whether for sale or otherwise to anyone who is not an authorised user.



How has digital participatory mapping influenced urban planning: Views from nine planning cases from Finland

Valtteri Nurminen^{*}, Saana Rossi, Tiina Rinne, Marketta Kytä

Aalto University, School of Engineering, Department of Built Environment, Finland

ARTICLE INFO

Keywords:

Influence of public participation
Public participation GIS (PPGIS)
Interview
Case study

ABSTRACT

Although the successfulness of public participation projects has been studied from many different perspectives, there is a lack of knowledge of how participation influences the planning outcomes. Through the interview study of nine Finnish urban planning projects, we studied how the use of a digital public participation GIS tool has influenced the outcomes of urban planning. In the selected cases the information collected with a PPGIS tool has been highly valued by the planners, leading to concretely influential participation in 6 out of 9 cases. In these cases, the planners gave concrete examples of how the information had influenced the created plan or draft. We created a model that describes how the information produced by participants is traveling from the participants to the outcome of the planning process. With this model, the main factors limiting the degree of influence were recognized, and actions were presented that could increase the influence.

1. Introduction

Public participation has during the last decades become an essential part of urban planning practices (see e.g., Lane, 2005) and it is included in planning legislation in many nations and coalitions such as the European Union (Lovrić et al., 2018). From the perspective of residents, participation provides the possibility to have a say in the matters of one's living environment. Participation has also been proven to provide more diverse, locally specific, and tacit knowledge, otherwise often unreachable for the planner, as well as making the planning more efficient and effective (Corburn, 2003).

Despite the efforts of researchers and practitioners, participatory planning practices still face some fundamental challenges: via traditional participation methods (1) it is difficult to realize large-scale, representative participation, (2) produce high-quality and usable knowledge and (3) realize effective and influential participation (Kahila-Tani et al., 2019). New, digital participation methods can potentially address these challenges. The COVID-19 pandemic has probably sped up the digitalization of public participation practices (Falanga, 2020; Morio, 2023; Panti et al., 2021) because traditional participation methods like focus group meetings and public hearings were not feasible options during lockdowns.

Among the most widely used digital methods is Public Participation GIS (PPGIS), which has been used by hundreds of cities (e.g., Babelon

et al., 2021; Kahila-Tani et al., 2019; Kytä et al., 2022). The use of PPGIS tools has been shown to promote large-scale, representative, and fair participation (Kahila-Tani et al., 2019). Moreover, it has been recognized that the use of PPGIS tools has the potential to increase the influence of participation on the outcome of the planning process. This is because the produced digital, place-based, experiential knowledge is easy to integrate into the existing planning datasets and systems, and the tangible visualizations connected to the specific aspects of the physical environment provide valuable insights for the planners (Brown, 2015; Kahila-Tani et al., 2016; Kahila-Tani et al., 2019). PPGIS surveys also facilitate the coexistence of contradictory experiential information, which can provide valuable knowledge to planners if presented as such, but which means that subsequent converging participatory methods are required for the successful resolution of conflicting interests (Brown & Kytä, 2018; Jankowski et al., 2022; Staffans et al., 2020).

Despite its potential, in practice, the use of PPGIS tools hasn't yet been shown to translate into increased influence on the outcomes of planning processes (e.g., Hasler et al., 2017; Jankowski et al., 2022; Kahila-Tani et al., 2016; Kahila-Tani et al., 2019). According to one study, PPGIS and its inherent knowledge of the spatial representation of participants helped planners build an argument for including citizens' views in planning decision-making and negotiations with investors (Bąkowska-Waldmann & Kaczmarek, 2021). However, the influence on the planning outcomes has been found to be severely limited by

^{*} Corresponding author at: Department of Built Environment, Aalto University, Otakaari 4, 02150, Espoo, Finland.

E-mail addresses: valtteri.t.nurminen@aalto.fi (V. Nurminen), saana.rossi@aalto.fi (S. Rossi), tiina.e.rinne@aalto.fi (T. Rinne), marketta.kytta@aalto.fi (M. Kytä).

institutional and legal barriers as well as the influence of powerful political and financial actors who are directly involved in the design and decision-making processes whereas citizens are excluded. (Bąkowska-Waldmann & Kaczmarek, 2021; Jankowski et al., 2022). The persisting questions raised by previous studies are whether PPGIS can truly lead to more equitable and sustainable outcomes in planning; by what means can organizational barriers limiting influence be overcome; and does doing so lead to increased influence of participants.

Therefore, to gain a deeper understanding of the current ways PPGIS is influencing planning and to identify the organizational barriers to PPGIS information dissemination, in this study, we analyze nine urban planning projects where PPGIS was used. We aim to learn how the use of PPGIS tools has influenced the outcomes of urban planning, in what kind of planning projects have the tools been used and how has the gathered information informed planning. If concrete planning outcomes cannot be shown, why has this been the case, and can something be done to increase the influence. We will also study more specifically what role the collected information has played in various phases of the planning process. To answer these questions, we interviewed local planners of nine urban planning projects from eight municipalities in Finland. We aim to produce knowledge that helps improve current public participation practices and showcases what kind of influence can result from participation, as well as from the utilization of PPGIS tools.

The scope of the studied projects ranges between master plans and detailed plans. Land use planning systems in several countries, such as Finland (Kanninen & Bäcklund, 2017), Australia (Searle, 2016), and Germany Basta et al., 2008) also include informal, non-statutory, and legally non-binding plans. A challenge related to participation in these informal levels of planning has been recognized. Kanninen and Bäcklund (2017) have pointed out that these informal systems aren't bound by the publicity and participation requirements of statutory planning systems. Yet, many strategic decisions are made on these informal levels of planning. Thus, from the perspective of participation, an essential question is how the residents' role is seen in these informal processes (ibid.). In this study, in four out of nine cases, the plans are informal and non-statutory. We recognized that the lack of legal obligation to organize participation in these cases didn't decrease the quality or amount of participation organized.

In the following section, we consider the concept of influence providing a background necessary for understanding the impact of public participation in urban planning. In section 3 we describe our research methods and the outline of the interviews. In section 4 we present the results of our study and highlight the concrete examples where information from PPGIS tools influenced planning outcomes. Lastly, in section 5 we discuss the findings and interpret the results.

2. The concept of influence

The ability to influence decision-making, planning, and implementation forms the core of participation (Kyttä & Kahila, 2006). However, influence is not an obvious, unidimensional, and objective quality that could be clearly defined and measured (Rowe & Frewer, 2004). When studying influence, it's necessary to first define the subject and the object, and what is meant by influence.

2.1. Defining influence

Rowe and Frewer (2004) have recognized that the definitions for influence can be divided into two categories. First, universal definitions mean that certain metrics for influence can be defined that can be applied in all participation processes and thus, can be used for comparing participation processes with one another. An example of this could be the fairness of participation. It would however be unlikely that researchers would come to an agreement over a single universal definition of fairness, and how it is measured. The second category comprises local definitions, in which case, influence depends on specific

attributes and goals of the participation process in question. Here the definitions of influence are generated for each subgroup with similar goals and attributes. For example, if we choose the local definition of 'achieving a better decision', only those participation processes where decisions were made could be evaluated and compared. There are also participation processes that are more preparatory, visionary, or informative without direct connection to any decision-making process, which would be left out. It could even be argued that every participation process is unique and thus the metrics for influence should be defined every time based on the specific situation (Rowe & Frewer, 2004). Syme and Sadler (1994) present an approach that states that the evaluation criteria should be agreed on between the public and the planner.

To elaborate on the point presented by Syme and Sadler (1994), regardless of whether the criteria are agreed upon or not, it's important to recognize that different actors have different views on influence. Rowe and Frewer (2004) point out that the participation process includes various stakeholder groups and what one considers effective might not be effective according to some others. For example, the residents could feel that their voice was heard and thus consider the participation influential, while some other actors could be dissatisfied with the outcome and therefore feel that the participation wasn't influential.

The concept of influence can also be divided into process and outcome influence (Brown & Chin, 2013; Rowe & Frewer, 2004). The participants usually expect that their input will have some kind of influence on the outcome of the planning process in question (Brown & Kyttä, 2014). However, the difficulty of measuring the influence of participation on the outcome of the planning process is widely recognized, and the research on outcome influence has been practiced less and more unsystematically (Rowe & Frewer, 2004). The main reasons for this are firstly the long timespan from participation to the realization of the outcome, and second, the outcomes are usually a sum of multiple different factors and viewpoints, so it's hard to tell whether a certain outcome is due to the input from participation or not. And lastly, if one wishes to study the influence of participation, the outcomes would need to be systematically evaluated afterwards, which isn't currently commonly done (e.g., Kahila-Tani et al., 2016; Koontz & Thomas, 2006; Rowe & Frewer, 2004).

Because of the challenges of evaluating the influence on the outcome, participation is often evaluated based on the success of the process instead, which is usually easier to do. It is often considered that if the participation is fulfilling the definitions of a good participation process, it would then be more likely that the outcome of the participation process would also be of higher quality. For example, if the participation process is well conducted it seems more likely that the results are more valid, and the decision-makers take the input from participation more seriously than when the participation process is poorly conducted (Rowe & Frewer, 2004).

In this paper, our approach is to study how information gathered with PPGIS influences planning and decision-making, and what happens to the information along the way from the participation process to the final planning outcome. Beierle and Konisky (2000) also highlight the importance of 'incorporating public views into decision making' as one of the main evaluation criteria in their study. Our approach to study the flow of participatory information in planning is supported for example by Häkli (2002), who states that one of the central goals of participation is to include the views of different actors during the planning process as widely as possible.

Due to the challenges of measuring the influence on the outcome in a structured and comparable manner, the aim of this paper isn't to create any framework for evaluation. The aim is rather to illuminate in a qualitative manner what happens to the information produced by participants, how it has informed planning outcomes, and possibly find explaining factors for why the high potential of PPGIS hasn't been shown to increase the influence of participant information on the planning outcomes. Thus, the influence in this paper is studied largely

based on local and case-specific definitions.

It should be highlighted that in this paper, with the word ‘outcome’ we refer to some kind of concrete plan or draft that is created in the planning process. Thus, in this paper, we do not regard the implementation of the plan in the physical environment. Furthermore, it should also be kept in mind that the purpose of participation isn’t to single-handedly provide views and solutions which then the planners follow as such. Instead, as Kahila-Tani et al. (2019) point out: ‘At best, participant knowledge can be more equally recognized parallel to other data sets used in a planning project’ (p. 27). Thus, even if the information from participation is taken perfectly into account it cannot be expected that the outcome is fully in line with the view of participants. Additionally, the influence cannot always be visibly seen in the outcome, if for example the PPGIS information supports the initial views of the planner, and thus no changes are needed. This, however, adds another layer to the complexity of evaluating the influence, since analyzing the outcome does not necessarily reveal the thought process of the planner. Interviewing planners, as we have done in this study, can help us understand the thought and decision-making process of the planner and thus provide us with a deeper understanding of the role of participatory information in a complex planning process.

3. Research methods

To understand how the information gathered with PPGIS is influencing outcomes, it is important to understand the thought process and different factors behind the decisions. Therefore, we conducted interviews with planners who have utilized the PPGIS tool Maptionnaire® to learn how and why PPGIS was used, what benefits the planners have gotten, and whether the collected information has had an influence on the outcome and whether the influence should be increased. Finally, the reasons why the gathered information did not have an influence were interesting for us.

Participant input is often regarded as knowledge (e.g., Brown, 2015; Hasler et al., 2017; Kahila-Tani et al., 2016). However, we consider the participant input to be information from the perspective of the planners, which is central to this study. We consider that only when the planner assigns value to the information, knowledge is produced from the information (see e.g., Rydin, 2007). To maintain consistency, the object of the study is the information collected with PPGIS.

3.1. Selection of cases

Maptionnaire® is used in many countries, but because different countries have different planning practices and legislative systems, it was decided that for the purpose of this study, all cases should focus on Finnish municipalities. The suitable projects were searched from the Maptionnaire database, where the completed surveys were archived. In selected cases, some form of concrete plan or draft had to be ready at the time of the interview. The planning project needed to be as recent as possible so that the planners would have a clear recollection of the case, and the likelihood of reaching the planner who originally was responsible for the survey would be rather high. When combining these two criteria, we ended up selecting projects realized between 2017 and 2020. The urban planning projects ranged from detailed plans to general plans, also including some informal plans.

In total, the data included 10 interviews from nine different cases, which were from eight different municipalities all over Finland. The chosen cases included (from the most general to the most detailed):

- Master plan*
- District plan
- Shore master plan*
- City center development plan
- Framework plan for station area
- Area development plan

- 3× Detailed plans*

Five out of nine plans (marked with*) were legally binding statutory plans, while the others represent non-statutory, guiding plans, with no legal implications. At the time of the interviews, all the cases were either ongoing or completed except the shore master plan, which was decided to be discontinued, but a draft was still completed. In all cases we interviewed the responsible planner, except in the case of the shore master plan, in which the responsible planner was unavailable, so another planner involved offered to participate in the interview. In the case of the master plan, two other relevant persons were interviewed, in addition to the responsible planner.

3.2. The structure of the interviews

We used semi-structured interviews (e.g., Adams, 2015) and selected certain themes and questions, while at the same time, the topic was freely explored. Since the influence in practice is a relatively unexplored topic, we decided to leave a lot of room for a free-flowing discussion, so the interviewees could freely present their experiences and opinions.

The main themes of the interview were:

- General information regarding the participation and planning process
- What happened to the collected information?
- How has the information been utilized?
- What happened to the information after the planning process?

4. Results

4.1. The influence of PPGIS information

According to our interviews, the planners were well acquainted with the results of the PPGIS survey and they had considered the findings thoroughly. In six out of nine cases, the planners were able to give concrete examples of how the information had influenced the created plan or draft. In two other cases, the planners described that while the information did not concretely show in the outcome, it had still influenced the thought process of the planner. This was evident in most of the cases, and one of the planners for example commented ‘There were a lot of extremely good comments, but we think that the majority of them are probably ones that we had already recognized and that mainly supported the goals that we had already set...’. There was only one case in which the PPGIS information couldn’t be utilized. This was because the collected information was too specific, considering matters related to the implementation phase rather than matters of land use planning. The information was still considered useful and there was an intention to share it later to be utilized in the implementation phase.

In each case, some information was considered unsuitable for the project for different reasons. This was most often due to the information being unfit with the boundary conditions set for the planning project (e.g., nature values or guidelines from higher plan levels that direct lower level plans), being unsuitable for the planning level in question (e.g., too detailed or too general information belonging to another plan level or department), and being unrealistic or otherwise unsuitable or unfeasible (e.g., due to resources). Some participants did not necessarily understand the constraints of the process and what is possible in planning, and they perhaps were not informed about these boundaries.

Many planners described that they were getting a lot of completely new information. One of the planners for example said that the participants mapped a lot of markings to a subarea that was not paid much attention to in the planning process. They continued that ‘...then I was like oh wow, people actually hang out there and like the place’. It was frequently brought up that the design of the survey and the formulation of the questions have a crucial role in determining the success of the survey and the usefulness of the collected information.

The utilization of the information was seen easier when participation is arranged already in the early stages of planning, the area of the plan is large enough so different kinds of options can be considered, the area of the plan is owned by the municipality, and there is, for example, no governmental or private actors involved. The planners considered that the participants often don't have much to say regarding abstract matters, and the more concrete the topic is, the more responses it gets.

4.2. Analyzing the flow of PPGIS information in planning processes

Based on the results of the interviews, we created a model representing the information flow. We tracked how the information traveled from the participants to the planning process and all the way to the planning outcome. This allows us to recognize if there are some barriers along the way that hinder the influence the information has. Six different phases can be identified, that are based on the interviews, and resemble the steps of the participation process from the planners' perspective. These phases are visualized below in Fig. 1.

Phase 0 happens already before the participation process has even started. In phase 0, it is decided what kind of information is going to be collected. We recognized that the desired information is most often related to current or historical connections to place, place qualities, values, or conditions, current behavioral patterns, or everyday practices in particular settings, and there was less emphasis on preferences for future land use planning and management (cf. Brown & Kyttä, 2014). The desired information is usually considering very concrete matters rather than abstract ones. In this phase, it is decided which matters the participants will have a say in.

In **phase 1** the knowledge the participants have is collected and translated into GIS format. The interviews revealed that by using Maptionnaire, the collection of information from participants is more efficient, representativeness is better, more participants can be reached who are more committed to responding, and the input can be accurately marked on the map. The identified risks included the threat of poor question formatting or poor understanding of the questions since there's

no immediate possibility to discuss the questions and survey themes with the participants. Also, the respondents' technological and map reading skills can pose a challenge. The overall impression was that the collection of information is happening relatively successfully and efficiently.

In **phase 2** the collected data is analyzed and turned into a report that visually and verbally presents the gathered information. In this phase, the information seems to be efficiently reaching the reports, without almost any of it dropping out on the way. One worry that some of the planners had, was that some information could be accidentally ignored if the planner doesn't understand some of the comments or points made. One of the planners commented that if there is a large number of open comments, it could be hard to digest all of them. For these reasons, it's also important to dedicate time to the analysis and interpretation of the information. However, the interviews indicated that the information is usually efficiently passing through this phase.

In **phase 3** the information and the created reports are transferred into the actual planning process. We found that in all studied cases, the collected information reached the responsible planner, as well as other relevant people. The only recognized challenge was that in the case of working with governmental actors, the information might not be reaching those actors. This was because the planner often negotiates with the governmental actors first, and only after that does the planner fit in the views of the participants. Many of the planners mentioned they had benefited from the highly visual nature of the Maptionnaire information. This together with the fact that the information is already in a digital format may explain the efficient transfer of information in this phase.

In **phase 4** the information is evaluated and aligned with the objectives, boundaries, and premises of the planning project. This phase turned out to be the biggest bottleneck in the process. Here it was first evaluated whether the information belonged to the plan level and area in question. Many of the planners had recognized that there's a lot of information that is unsuitable for the project in question but could however possibly be utilized in some other projects or departments. This

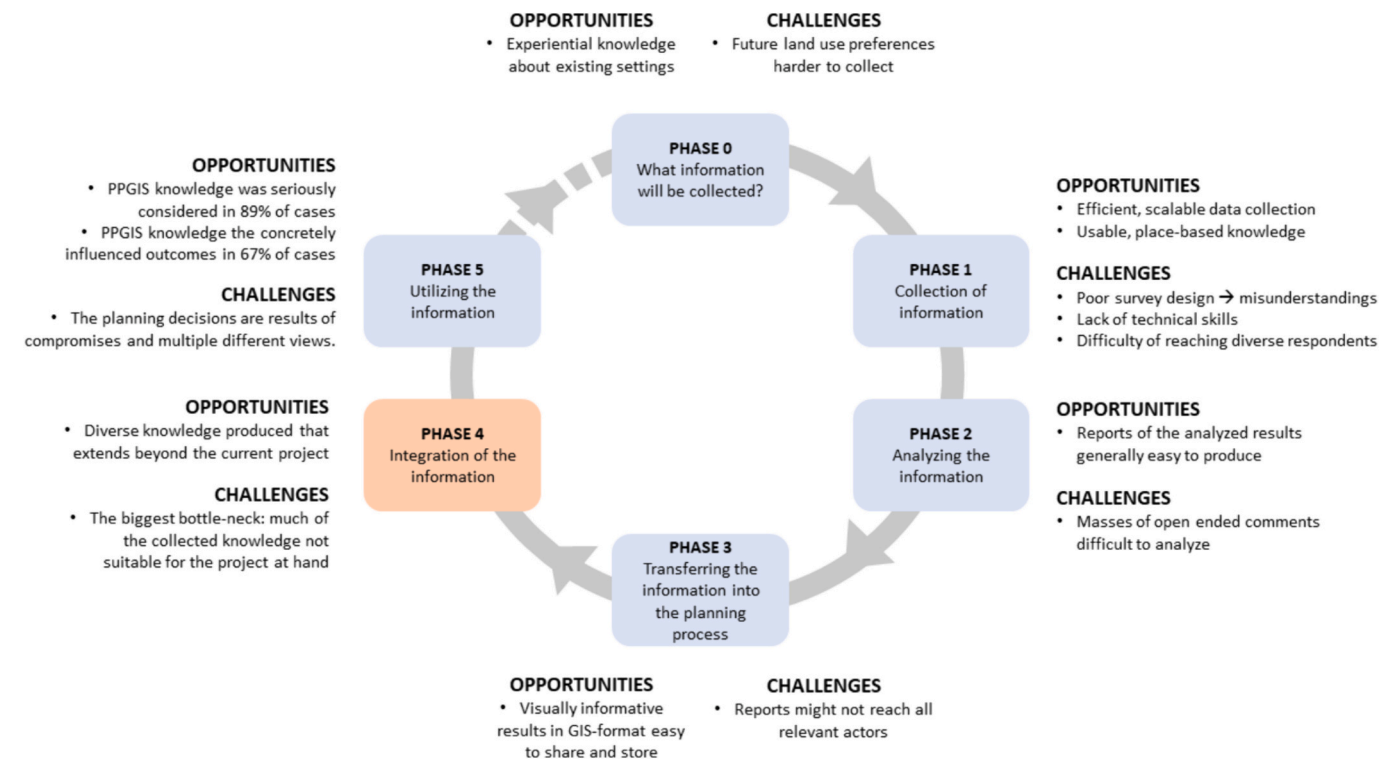


Fig. 1. The information flow model. We recognized that in each phase there are certain factors that can either foster or hinder the influence of the information. These factors are presented as 'opportunities' and 'challenges'.

information was sometimes forwarded to other planners or departments, but this usually happened spontaneously by individual planners. One of the planners mentioned that at this point the information chain can be interrupted by human reasons (e.g., forgetting, issues of communication, or lack of time). It was also frequently brought up that it cannot be known if the forwarded information is taken into account when it arrives at the correct department. One planner described that:

The participants usually also answer a lot of things that weren't directly asked, especially in the case of open questions, so there are often a lot of answers considering other departments, so the information is then forwarded to those departments. But of course, since everyone's hands are so full of work, no one is going to read them at that moment, but at least the impression remains that these were asked at some point.

Therefore, without any system for storing the information, it can be troublesome to find the information afterwards and it's up to the responsible planner to decide what information could be useful for others. Even if the planner who has originally possessed the information would wish to utilize it in the future, it can be laborious to locate the data afterwards. One of the planners mentioned that the information is always stored somewhere, but it's often scattered around.

In two of the municipalities, Espoo and Lahti, there is an organization-wide system in use for storing the PPGIS information, Locus Cloud by Trimble. When using a digital archiving system, the data (both geo-located and non-geo-located) can be easily found, and it is accessible to everyone in the organization. This way, the planners can easily see if there is information available whenever needed, and they can more easily decide what interests them. This enables the information to have influence long after the initial participation process is finished, and thus there are more opportunities for the input of the participants to have an influence. With successful information sharing and storing practices, the information which is dropping out in phase 4 of one project, could then be redirected back to phase 3 of another project.

The information usually becomes outdated at some point, which was discussed with some of the planners. The estimations for the lifespan of the PPGIS information varied from a couple of years to around 10 years, largely depending on the type of information. For example, information considering an issue needing an urgent fix, such as a pothole on the road is likely to be fixed rather quickly, while for example, information considering the scenic value of a river has a much longer lifespan, if any expiration date at all.

In this phase, it is also evaluated whether the information is compatible with the boundary conditions, development directions, and objectives of the planning process, which again eliminates a lot of information from consideration. This could possibly be mitigated by better informing the residents about the planning process and the restricting factors. However, as one of the planners wished for even more 'boldly imaginative ideas', attention might need to be paid to ensuring that the creativity and imagination of the participants are not discouraged even if there is more information provided. The planner also brought up that the participants tend to be more imaginary when using Maptionnaire compared to the traditional methods. Additionally, if in phase 0 the desired information and the topic were defined more precisely, the collected information could possibly be more usable.

If the information proceeds to phase 4, even if it will be dropped out eventually, it has already had at least some influence on the thinking of the planner, since the decision has to be made that the information is, for example, incompatible with the development directions. This way, the planner gets to know that there are also opposite views to the chosen direction of the development. This is essential from the agonistic planning point of view: it's important to also recognize those who are fundamentally disagreeing with the dominant view, and as [Bäcklund and Mäntysalo \(2010\)](#) describe, maintain mutual respect despite the

disagreements.

In **phase 5** the information which has successfully passed all previous phases is suitable to be utilized in the actual planning decisions. In eight out of nine cases, the information reached this phase, even though in each case a lot of information also dropped out along the way. However, this does not automatically mean that the decisions will be made based on the collected information because other options could still be chosen based on the judgments of the planner. There were three cases where the influence did not concretely show in the outcome. In one of those cases, all the collected information dropped out in phase 4 because it belonged to the implementation phase. In two other cases, the information reached phase 5, as it was successfully integrated into the planning processes. However, in these cases, the planners mentioned that the benefit they got from the information was not concrete, since the information mostly supported certain thoughts they already had. In six of the nine cases, the information can be considered to influence both the thought process of the planner and the concrete outcome of the planning.

4.3. The examples of concrete influence

In six out of nine cases the interviewees were able to provide concrete examples of how the information collected with the Maptionnaire was influencing the outcome of planning. At the time of most of the interviews, some time had already passed from the participation and planning processes. Because of this, the planners could not remember the full and comprehensive range of different aspects that had concretely been influenced by the information, but they instead brought up a few prime examples which are presented in [Table 1](#).

5. Discussion

According to the interviews, in the selected cases the information collected with a PPGIS tool was highly valued by the planners, leading to concretely influential participation in 67% of the studied cases. Many of the planners mentioned that the participants are experts of their own living environments. The planners were able to provide examples where PPGIS information concretely influenced the outcome of the planning process. Even in the cases where the PPGIS information did not concretely show in the outcome, the information influenced the thought process, for example, by validating the initial views of the planner. In only one case none of the information could be utilized, due to it belonging to the implementation phase, rather than the planning phase at hand. Similar discrepancies between the scope of the plan and the citizens' concerns have been found to limit the impact of PPGIS on planning outcomes ([Jankowski et al., 2022](#)). As we found in our cases (see [Fig. 1](#)), this is mainly a challenge to solve in phase 4, the integration of information, to ensure that relevant information is transmitted to the appropriate sector within the municipality or to relevant stakeholders and contractors in charge of implementing the plans.

The planners expressed that the use of PPGIS increased the quality of the participation process. In their experience, PPGIS methods produced data with better representativeness, more equal participation, and increased quality and amount of produced information. While the higher number of participants reached has been recognized in previous research (e.g., [Bąkowska-Waldmann & Kaczmarek, 2021](#); [Jankowski et al., 2022](#); [Kahila-Tani et al., 2019](#)), they have not shown an improved quality of the information produced in the processes such as was found in this study.

The PPGIS information turned out to be more influential than was expected based on earlier studies. Where [Bąkowska-Waldmann and Kaczmarek \(2021\)](#) found that PPGIS results were mainly used as a diagnostic tool and to corroborate existing planning visions and validate prior knowledge, our study found that PPGIS information had significant impacts on the goal setting of planning processes (cases 2, 3 and 5) as well as specific planning proposals (cases 1–6). However, the

Table 1
The examples of concrete influence.

Case	Type of the case	Description of influence
Case 1	Master plan	The input of participants was utilized in the process of deciding the location for new service development. Also, the appreciation for a riverine area turned out to be a lot higher than what was expected by the planner, which was then considered in the plan.
Case 2	District plan	The residents were concerned about the preservation of nature due to the highly dense urban structure. As a result, nature was 'set as a starting point' for the plan. The green areas were decided to be preserved despite the extremely high land use intensity by Finnish standards. The aspect of nature was officially raised as a main theme of the vision and development of the area. The participants were also strongly resisting the reduction of parking spaces in the center. Because of this, planners decided to reduce parking spaces gradually in phases. Temporary parking space would be provided so that the residents would have time to adapt to the change.
Case 3	City center development plan	Many aspects of the development plan were directly drafted based on the created PPGIS heat maps, presenting the areas of clusters of different markings by participants. These included various aspects such as important places, places and ideas for development, unsafe areas, and walking routes. The participants also brought up some interesting new development areas that the planner had not thought of. Due to this, these areas were marked on the plan as potential sites for development.
Case 4	Framework plan for a station area	The input of the participants was used to find the best possible locations for new under and overpasses to get across the railway. Additionally, the information was also utilized when the accessibility of the area was further planned and for example the new routes were planned based on the needs of the participants.
Case 5	Area development plan	The information was used to identify development ideas and locations because as the planner stated, 'The residents are perceived as the number one experts in the area'. Based on the input of the participants, new routes were planned, and transportation connections were considered. The need for new services was also marked on the plan.
Case 6	Detailed plan	The participants pointed out a small forest area and considered that it would be important to make further nature evaluations there. This insight encouraged planners to re-evaluate the area. The further evaluations done for the natural area did not indicate anything preventing the development of that area. This is, however, a good example of the residents recognizing a real need for further evaluations, and the experts agreeing on it. The information was also used for defining the location of new housing and new walking routes. In the end, the new housing was located in line with the participants' wishes.

definition of influence is not standardized so it might vary between studies. In this paper, there was no evaluation framework formed or systematic comparison conducted between the PPGIS and other participation methods. Although it was shown that the PPGIS information often concretely influenced the outcome of a planning process, we did not systematically evaluate how these findings compare with similar results using other methods. It should also be noted that in this study the

definition of outcome was decided to be a planning document, such as a plan or draft. Therefore, the influence of PPGIS information was only studied in relation to planning documents, and thus no further evaluation of later implementation exists.

In this study, in half of the cases studied, the plans were statutory and legally binding, while in the other half, the plans were non-statutory and legally non-binding. We recognized that the lack of legal obligation to organize participation in these cases did not decrease the quality or amount of participation organized. It even seemed that in these cases there was even more room left for the views of the participants. This is in line with the finding of [Jankowski et al. \(2022\)](#) that legal prerequisites for both the participation process and the justification of outcomes strain the potential influence of participants' inputs. Also, the financial considerations for development on privately owned land highlighted by [Bąkowska-Waldmann and Kaczmarek \(2021\)](#) usually have a smaller priority on more abstract, informal planning levels. On one hand, if participants' views are considered also when planning institutions are not legally required to do so, it is good news from the perspective of participation. On the other hand, it could be argued that if the plan is informal and legally non-binding, the wishes of the participants can be included more liberally, without the need to consider resources or becoming obligated to act based on this information later in the detailed planning process or in the implementation phase.

The storing and dissemination of PPGIS information was found as a key barrier for influence in previous studies, and [Jankowski et al. \(2022\)](#) point out that conflicting points of views represented in PPGIS results are often agglomerated when the information is transferred to planning professionals from the officials conducting the survey. In our cases, this limitation seemed less impactful due to the planners' direct contribution to each survey's design and result analysis, but this information might not be transmitted to other processes. However, in the Espoo and Lahti cases, where the PPGIS mappings are shared in full on the city-wide planning information database, officials in other projects and sectors can also access the full datasets which represent also potential conflicts in participants' views, building more nuanced understanding of local issues as a background for future planning and participation processes.

It is possible that successful survey processes were overemphasized in our study due to self-selection and positivity bias in the interviewees (e.g., [Heckman, 1990](#); [Hoorens, 2014](#)). We also cannot ascertain how the influence of participation shows in the physical implementation of the plans, as they had not yet been realized in the built environment. Future longitudinal research monitoring the physical implementation of the plans and evaluating the influence of participation could answer this question.

6. Conclusions

The main factors limiting the influence of PPGIS information were either the unsuitability of the information with the plan level, area, or department in question or the unsuitability of the information with the boundary conditions and development directions. We propose three possible solutions for this: (1) informing the participants regarding different limitations, (2) proper data management (storing, organizing, maintaining and sharing) so that it can be utilized by the entire organization, and (3) defining the desired information and the topic more precisely already in the beginning, so that all of the collected information would be as usable as possible.

Other recognized factors that can limit the influence of PPGIS include for example poor question formulation, lack of discussion when the participation takes place only via online survey, and insufficient technology and map-reading skills of the participants. Additionally, it was recognized that the input of the participants is harder to consider if the plan area is not large enough to enable different options and if there are also private or governmental actors included. It should be noted that for the PPGIS information to be influential, time needs to be dedicated to the interpretation and digestion of the information. The interviewed

planners emphasized the importance of good survey question formulation in ensuring the quality of the information. Defining the best practices for designing a PPGIS survey and questions for participatory planning practices is an important topic for future research.

Archiving the results of old PPGIS surveys could provide an additional benefit. In the future when new PPGIS surveys are conducted, the results could be compared to e.g., follow the possible influence of new development. In such a case, it would be important to use the same questions, for comparable results. This could provide valuable information regarding certain trends, as well as the success of planning projects. When archiving the results, a crucial question is also when (if ever) the information becomes outdated. Some of the planners interviewed in this study estimated that the lifespan of the information could vary from a couple of years to around 10 years, largely depending on the type of information. Proper data management processes and plans would help the organizations in efficient archiving practices.

In this paper, we approached the topic of influence from the perspective of planning institutions and professionals. Future research is needed to study how participants and different stakeholders perceive their opportunities to influence planning, and how they can gain information on the ways participatory information was used to inform planning outcomes.

Funding

Transformative Cities -project contributed to financing the work of VN, TR and MK. Transformative Cities has received funding from the European Union – NextGenerationEU instrument and is funded by the Academy of Finland under grant number No 352943.

VN has received funding from Mapita Oy for the data collection.

CRedit authorship contribution statement

Valtteri Nurminen: Writing – original draft, Methodology, Conceptualization. **Saana Rossi:** Writing – original draft, Conceptualization. **Tiina Rinne:** Writing – original draft, Conceptualization. **Marketta Kytä:** Writing – original draft, Supervision, Funding acquisition, Conceptualization.

Declaration of competing interest

None.

References

- Adams, W. (2015). Conducting semi-structured interviews. In K. E. Newcomer, H. P. Hatry, & J. S. Wholey (Eds.), *Handbook of practical program evaluation*. <https://doi.org/10.1002/9781119171386.ch19>
- Babelon, I., Pánek, J., Falco, E., Kleinhans, R., & Charlton, J. (2021). Between consultation and collaboration: Self-reported objectives for 25 web-based Geoparticipation projects in. *Urban Planning International Journal of Geo-Information*. <https://doi.org/10.3390/ijgi10110783>
- Bäcklund, P., & Mäntyselä, R. (2010). Agonism and institutional ambiguity: Ideas on democracy and the role of participation in the development of planning theory and practice – The case of Finland. *Planning Theory*, 9(4), 338. <https://doi.org/10.1177/1473095210373684>
- Bąkowska-Waldmann, E., & Kaczmarek, T. (2021). The Use of PPGIS: Towards reaching a meaningful public participation in spatial planning. *ISPRS International Journal of Geo-Information*, 10(9), 581. <https://doi.org/10.3390/ijgi10090581>
- Basta, C., Struckl, M., & Christou, M. (2008). *Overview of roadmaps for land-use planning in selected member states* (p. 23519). EUR: JRC scientific and technical reports.
- Beierle, T., & Konisky, D. (2000). Values, conflict, and trust in participatory environmental planning. *Journal of Policy Analysis and Management*, 19(4), 587–602. <http://www.jstor.org/stable/3325576>
- Brown, G. (2015). Engaging the wisdom of crowds and public judgment for land use planning using public participation geographic information systems. *Australian Planner*, 52(3), 199–209.
- Brown, G., & Chin, S. Y. (2013). Assessing the effectiveness of public participation in Neighbourhood planning. *Planning Practice and Research*, 28, 563–588.
- Brown, G., & Kytä, M. (2014). Key issues and research priorities for public participation GIS (PPGIS): A synthesis based on empirical research. *Applied Geography*, 46, 122–136. ISSN 0143-6228 <https://doi.org/10.1016/j.apgeog.2013.11.004>
- Brown, G., & Kytä, M. (2018). Key issues and priorities in participatory mapping: Toward integration or increased specialization? *Applied Geography*, 95, 1–8. <https://doi.org/10.1016/j.apgeog.2018.04.002>
- Corburn, J. (2003). Bringing local knowledge into environmental decision making: Improving urban planning for communities at risk. *Journal of Planning Education and Research - J Plan Educ Res.*, 22, 420–433. <https://doi.org/10.1177/0739456X0302200400>
- Falanga, R. (2020). Citizen participation during the COVID-19 pandemic: Insights from local practices in European cities. *Publication of Friedrich Ebert Stiftung*. <http://hdl.handle.net/10451/45726> ISBN: 978-972-9264-05-4.
- Häkli, J. (2002). Kansalaisosallistuminen ja kaupunkisuunnittelun tiedonpolitiikka. In P. Bäcklund, J. Häkli, & H. Schulman (Toimittajat) (Eds.), *Osalliset ja osajat: Kansalaiset kaupungin suunnittelussa* (pp. 110–124).
- Hasler, S., Chenal, J., & Soutter, M. (2017). Digital tools as a means to Foster inclusive, data-informed urban planning. *Civil Engineering and Architecture*, 5. <https://doi.org/10.13189/cea.2017.050605>
- Heckman, J. (1990). Selection Bias and self-selection. In J. Eatwell, M. Milgate, & P. Newman (Eds.), *Econometrics. The new Palgrave*. London: Palgrave Macmillan. https://doi.org/10.1007/978-1-349-20570-7_29
- Hoorens, V. (2014). Positivity Bias. In A. C. Michalos (Ed.), *Encyclopedia of quality of life and well-being research*. Dordrecht: Springer. https://doi.org/10.1007/978-94-007-0753-5_2219
- Jankowski, P., Forss, K., Czepkiewicz, M., Saarikoski, H., & Kahila, M. (2022). Assessing impacts of PPGIS on urban land use planning: Evidence from Finland and Poland. *European Planning Studies*, 30(8), 1529–1548. <https://doi.org/10.1080/09654313.2021.1882393>
- Kahila-Tani, M., Broberg, A., Kytä, M., & Tyger, T. (2016). Let the citizens map—Public participation GIS as a planning support system in the Helsinki master plan process. *Planning Practice and Research*. <https://doi.org/10.1080/102697459.2015.1104203>
- Kahila-Tani, M., Kytä, M., & Geertman, S. (2019). Does mapping improve public participation? Exploring the pros and cons of using public participation GIS in urban planning practices. *Landscape and Urban Planning*, 186, 2019. ISSN 0169-2046.
- Kanninen, V., & Bäcklund, P. (2017). Kansalaisosallistumisen institutionaaliset rajat. In P. Bäcklund, J. Häkli, & H. Schulman (Eds.), *Kansalaiset kaupunkia kehittämässä* (pp. 16–33). Tampereen Yliopistopaino. <http://urn.fi/URN:ISBN:978-952-03-0623-6>
- Koontz, T., & Thomas, C. (2006). What do we know and need to know about the environmental outcomes of collaborative management? *Public Administration Review*, 66(s1), 111–121.
- Kytä, M., Fagerholm, N., Hausner, V., & Broberg, A. (2022). Maptionnaire. Accepted to be published in Burnett, C. In *Evaluating participatory mapping software*. Springer.
- Kytä, M., & Kahila, M. (2006). *PehmoGIS elinympäristön koetun laadun kartoittajana*. Yhdyskuntasuunnittelun Tutkimus- Ja Koulutuskeskuksen Julkaisuja. B. ISBN: 978-951-22-8832-8.
- Lane, M. B. (2005). Public participation in planning: An intellectual history. *Australian Geographer*, 36(3), 283–299. <https://doi.org/10.1080/00049180500325694>
- Lovrić, N., Lovrić, M., & Konold, W. (2018). A grounded theory approach for deconstructing the role of participation in spatial planning: Insights from Nature Park Medvednica, Croatia. *Forest Policy and Economics*, 87, 20–34. <https://doi.org/10.1016/j.forpol.2017.11.003>
- Morio, C. (2023). Evolution of the legal framework in Europe for the use of digital participation at the “local” level: The French case. In G. Rouet, & T. Côme (Eds.), *Participatory and digital democracy at the local level. Contributions to political science*. Cham: Springer. https://doi.org/10.1007/978-3-031-20943-7_3
- Panti, C. M., Cilliers, J., Cimadomo, G., Montaña, F., Olufemi, O., Torres Mallma, S., & van den Berg, J. (2021). Challenges and opportunities for public participation in urban and regional planning during the COVID-19 pandemic—Lessons learned for the future. *Land*, 10, 1379. <https://doi.org/10.3390/land10121379>
- Rowe, G., & Frewer, L. (2004). Evaluating public participation exercises: A research agenda. *Science, Technology & Human Values*, 29(4), 29. <https://doi.org/10.1177/0162243903259197>
- Rydin, Y. (2007). Re-examining the role of knowledge within planning theory. *Planning Theory*, 6(1), 52–68. <https://doi.org/10.1177/1473095207075161>
- Searle, L. (2016). Landscapes of Accumulation: Real estate and the neoliberal imagination in contemporary India. Chicago and London: The University of Chicago Press May 2018. *International Journal of Urban and Regional Research*, 42(3), 541–542. <https://doi.org/10.1111/1468-2427.12640>
- Staffans, A., Kahila-Tani, M., Geertman, S., Sillanpää, P., & Horelli, L. (2020). Communication-oriented and process sensitive planning support. *International Journal of E-Planning Research*, 9(2), 1–20. <https://doi.org/10.4018/IJEPR.2020040101>
- Syme, G., & Sadler, B. (1994). Evaluation of public involvement in water resources planning: A researcher-practitioner dialogue. *Evaluation Review*, 18(5), 523–542. <https://doi.org/10.1177/0193841X9401800501>