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Does mapping improve public participation?

Exploring the pros and cons of using Public Participation GIS in urban planning practices

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Abstract

While participatory urban and regional planning have become a widely accepted approach to enhance the democratic aims of community and urban development, challenges still remain. Planners lack the knowledge of usable tools to reach broader groups of participants, which can turn participation into a small-group elitist activity. Also, the quality and utilisation of the knowledge produced is problematic, the collected data remains invisible and systematic analysis is often not realized. In this article, we ask whether digitally supported PPGIS (public participation Geographical Information Systems) tools can help addressing these challenges. Through a critical analysis and reflection upon over 200 real life planning cases in Finland (62%) and other countries (38%) using PPGIS methodology we study the ability of PPGIS tools to (1) enhance effective arrangements of public participation, (2) reach a broad spectrum of people and 3) produce high quality and versatile knowledge. Our results indicate a variety of advantages and disadvantages in using PPGIS methodology in urban and regional planning practice. By categorizing the pros and cons of using PPGIS in practise, we enable planners to implement more inclusive and people-centred urban and regional planning in the future.

Introduction

Participatory urban and regional planning is widely accepted among those countries acknowledging the democratic aims associated with community and urban development. (cf. Aarhus Convention, 1998). Many countries have legislated to realise participatory planning in all urban and regional planning projects. While participation advances justice and fairness, it also makes the public's preferences visible to decision-makers and increases the quality of the decisions (see Innes, 2004). Despite the legitimacy offered by participatory approaches, challenges remain. The practical implementation of participatory planning is often problematic. Participation is rarely comprehensive, while the data produced seldom translates into influential knowledge. As a result, participatory planning can be frustrating both for the participants and for those arranging such processes (Kahila-Tani, 2015).

We argue that these challenges hinder the realisation of efficient, influential and large-scale public participation. *The first* challenge resonates with participatory planning practices. In general, planners lack the knowledge of usable methods (see Vonk et al. 2005; Geertman, 2002). *Secondly,* challenges remain in reaching broader groups of participants. Typically, few participants are active and capable of attending, which turns participation into a small-group elitist activity. *The third* challenge concerns the quality and utilisation of the knowledge produced. Often the data collected remains invisible, is not systematically analysed or is neglected in the planning process.

Meanwhile, digitally supported participation has taken huge steps forwards in recent years. A few excellent reviews exist that critically review a variety of digital participatory platforms or online technologies (Falco & Kleinhans, 2018; Afzalan & Muller, 2018) or that study more

closely one type of digital participation like participatory apps (Ertiö, 2015). In this paper, we will concentrate on identifying the advantages and disadvantages of online Public Participation Geographical Information Systems (PPGIS) tools, which provide digital means to support map-based dialogue and data collection.

A few earlier studies have also focused on the evaluation of online PPGIS projects. These include the study by Brown and Kyttä (2014), who studied about 40 cases in terms of the participation rates, spatial data quality as well as the possibilities to increase public participation and to evaluate the effectiveness of PPGIS. The effectiveness of PPGIS project was analysed more deeply by Brown and Chin (2013), who distinguished between process and outcome effectiveness. Czepkiewicz et al (2017) evaluated participant recruitment methods of Geo-questionnaires and focused on sample representativeness, participant engagement and data quality. In this paper, we will ask whether PPGIS tools help to address the topical challenges of public participation. Unlike these earlier studies, the current study focuses on projects where PPGIS tools have been utilised by urban planners and decision makers themselves, not by researchers.

Below, we will first address the three challenges of current participatory planning processes. In the Results-section we will critically analyse and reflect upon 203 real life planning cases using PPGIS methodology in Finland (62%) and in some other countries e.g. US, Denmark and Germany (38%). Our critical analysis is divided into three sections: the ability of PPGIS tools to (1) enhance effective arrangements of public participation, (2) reach a broad spectrum of people and (3) produce high quality and versatile knowledge. The objective of this study is to identify a variety of advantages and disadvantages in using PPGIS methodology in urban and regional planning practice (cf. Kahila-Tani, 2015). These critical

reflections are needed to understand whether PPGIS tools enhance influential public participation and planning outputs that lead to better environmental and social outcomes (Koontz & Thomas, 2006). These reflections are beneficial both for the practitioners applying various tools in their participation efforts as well as for the scientific community who are responsible for developing the tools and studying their usefulness.

1. Challenges of participatory planning process

Although public participation has become a common practice in the field of urban and regional planning, the studies highlight a slender influence on the decision making process and actual planning outcomes (Irvin & Stansbury, 20014; Beresford & Hoban, 2005; Bäcklund & Mäntysalo, 2010). Among the identified reasons are inadequate and inconvenient methods, like public hearings and written statements (Healey, 1997; Halvorsen, 2001; Innes & Booher, 2004; Kingston, 2007). Although many cities use a great array of various methods, typically these methods do not attract wide groups of participants (Laurian, 2004; Brown, 2015). It can also be questioned whether the information gathered through public participation actually enhance the planning outputs or environmental and social outcomes (Koontz & Thomas, 2006). Nevertheless, organisations and planners need more support to understand how to design good quality participation processes to achieve desirable outcomes (Marzuki, 2015). The notions we have made through the implemented real life PPGIS projects reflect these general challenges well. In this chapter we will elaborate on the identified three main challenges of current participatory planning processes in more detail. The challenges are named as: (1) effective arrangements of public participation; (2) ability to

reach a broad spectrum of people and (3) the production of high quality and versatile knowledge.

Challenge 1: Effective arrangements of public participation

The motivations involved in participating actively in planning processes are differentiated across the various stakeholder groups involved. Reed et al. (2018) divides these motivations into three groups. *Pragmatic motivations* aim to reach better decisions that are more likely to be implemented. *Normative motivations* stem from the democratic right that requires the engagement of people in the major decisions affecting them (Reed et al. 2018). Third, the motive can be to *enhance trust* in decision-making processes to create social cohesion among the different stakeholders (see also Rowe & Frewer 2004).

Urban planners are often driven by normative motivations as well as by an attempt to build trust by promoting learning (Friedmann, 1987). Instead, we argue that more pragmatic motivations, aiming to influence directly process decisions and outcomes, could be highlighted more. Suspicion is often generated among stakeholders by the lack of clear motivations in respect of public participation. Any solid participation process must acknowledge that these motivations are relevant and worthy of explicit incorporation. As such, public participation processes should not be planned too strictly in advance (Leino, 2012). Instead, more space should be given to the situatedness of the various stakeholders, promoting a locally sensitive - contextualised participation process.

While the development of digital tools has significantly advanced, still the so-called implementation gap generates a mismatch between the supply of, and the demand for, planning support tools (Vonk et al. 2005; Schrijnen, 2010). This gap in the assimilation of

digital tools is a consequence of isolated tool-development by researchers or industry, based on limited knowledge of end-users, i.e. urban planners and residents' actual needs (Vonk & Geertman, 2008). Moreover, digitalisation here faces similar barriers as public participation more generally. Namely, institutional barriers reflect local administrative tensions that condition the role of participation. These tensions appear between the changes in the operational environment managing urban and regional planning tasks and the procedures governed by law (Bäcklund & Mäntysalo, 2010). Individual barriers refer to the varying value-systems of planners and to the status of the individual planner in the organisation. Although innovative planning practises are often led by the most advanced planners, individual as well as institutional barriers are surmountable.

Challenge 2: Ability to reach a broad spectrum of people

The decision to participate in a planning process is always made at the individual level (Laurian, 2004). Citizens should not only be heard but also have an input into matters affecting their interests and concerns (Douglass & Friedmann, 1998). This creative input can be a result of *individual participation* when a person participates in her/his capacity as a single resident or *collective participation* through membership in a local association or network (Table 1). Those, who remain silent by not participating, can presumably still have preferences that differ from the proposed views. For Sandercock (1995) the epistemology of multiplicity denies the view that those who remain silent do not have preferences or are indifferent. We thus agree with Albrechts (2004), who notes that the empowerment of the 'ordinary' residents and 'deprived' groups is necessary, because these are normally the 'silent' ones.

Although many techniques exist to arrange the participation of large groups of citizens, e.g. town meetings, interactive web-dialogues, workshops and focus groups (Innes, 2004), the kind of pluralistic thinking that introduces a diversity of interests to support the creation of more innovative planning proposals remains rare (Godschalk, 1971). Digitalisation has had a significant impact on participation mechanisms through a variety of information and communications technology (ICT) tools like social media and GIS-based methods (Luna-Reyes et al., 2012) making it possible to integrate the differing voices of plural society more efficiently into current planning practices (Brown & Kyttä, 2014; Sieber, 2006). There is, however, evidence that digital tools attract different set of participants than more traditional tools (McLain et al. 2017). Thus, digital tools like PPGIS should be seen as complementing, not replacing the existing set of analog participation tools by offering quicker and robust ways of creating a channel between the various actors.

Nevertheless, with suitable tools even large groups can develop visions (Innes, 2004) and the voices of crowds can be turned into a wisdom of crowds and even, eventually, into evidence. Surowiecki (2004) describes a phenomenon where a group's collective answer to a question is found to be as good or better than that of any of the individuals in the group or an expert. The members of the group need not be exceptionally well-informed or rational to reach these wise decisions. This view, that crowds can contain collective wisdom, contradicts the stereotypical view of crowds as thoughtless or irrational. Surowiecki (2004, 10) outlines four conditions that are necessary for a wise crowd: (1) diversity of opinion (each person should have some private information), (2) independence (persons' opinions are not determined by those around them), (3) decentralisation (people are able to specialise and draw on local knowledge), and (4) aggregation (there is some mechanism for turning private judgments into

a collective decision). In Table 1 we have differentiated individual and collective participation following these four conditions (see Table 1).

Table 1. *Comparisons between individual and collective participation (modified after Brown, 2015).*

	Individual participation	**Collective participation**
Diversity of opinion	*Each person should have the opportunity to share their private information*	*The private information of different persons' is filtered through groups aims*
Independence	*Peoples' opinions are not determined by those around them*	*Peoples' opinions form part of the joint understanding of the group*
Decentralisation	*People are able to specialise and draw on local knowledge*	*Combines and acknowledges local knowledge from different sources*
Aggregation	*Some mechanisms exist for turning private judgements into public judgement*	*More effective mechanisms for turning private judgements into public judgement*

In our view, both individual and collective participation are needed to reach the broader spectrum of people, this combination can encompass the plural voices of society (Innes, 2004) by ensuring a broad range of public involvement.

Challenge 3: Production of high quality and versatile knowledge

Residents are strongly attached to the places where they live. Healey (1997) states: *"The place where we live is 'our' place – something we identify with at a feeling level. As somewhere laden with memories, associations, hopes, even family history, it imparts layers of meaning no outsider could even guess at. The best way to access all this is through the people who already live there."* Healey (1997) also notes, that the progressive challenge is therefore

194 to acknowledge different ways of experiencing and 'make sense together'. Separate, single
195 and scattered pieces of opinions, experiences etc., produce data sets that can be turned to
196 knowledge constructed through social processes (Rydin, 2007).
197
198 Following this, participatory planning practices should apply the interpretative approach to
199 urban and regional planning where attention is simultaneously paid to the objective and
200 physical matters of place and to the subjective and social concerns of place. The
201 interpretative approach can also turn the traditional 'will to order' into the 'will to connect'
202 multiple, overlapping networks among planning practices (Davoudi, 2012). This kind of
203 knowledge-informed planning (Kahila-Tani, 2015) differs from evidence-based planning that
204 solely embraces scientific, 'objectively' harvested knowledge. Knowledge-informed planning
205 acknowledges the need to attain diverse and plural information that has to be further
206 processed through the decision-making process. Knowledge-informed planning combines the
207 instrumental and deliberative planning paradigms (cf. Raymond et al. 2014): it uses tools and
208 technical ways of obtaining valid and even contradictory information, understanding the need
209 to further elaborate this knowledge through deliberative actions. This is an ongoing process,
210 where the deliberative actions taken also produce new knowledge.
211
212 Various modes of engagement produce different kinds of knowledge: modes that support
213 one-way flows of information to publics and stakeholders (communication mode), feedback
214 seeking (consultation mode) and two-way knowledge exchange and joint formulation of
215 goals and outcomes (deliberative and co-productive modes) (Rowe & Frewer 2004). Brown
216 (2015) suggests that adding the place component makes the knowledge potentially more
217 usable and influential in planning practices. Although various digital tools have accelerated
218 data gathering from residents, questions remain: Is this data of a high quality? How has this

data and the tools been received by planning organisations? How does the data influence the existing planning system and existing planning traditions? The 'how to' of the 'translation' of local knowledge enabling it to be included in the formal planning process remains an open question (e.g., see Rydin, 2007). The following empirical section is based on the analysis of over 200 public participation cases that have applied online participation mapping methodology. These projects are PPGIS studies that have been implemented in the fields of urban and regional planning independently by planners who have been using PPGIS-service in their work.

2. Methods and data

Since 2005, Aalto University has developed online mapping surveys in close co-operation with planners. These so-called softGIS surveys, as they were originally called (Kahila & Kyttä 2009), were later (in 2014) developed as an online, 'do it yourself', service of Maptionnaire (https://maptionnaire.com/). Maptionnaire is an advanced example of PPGIS (Public participation GIS) methodology enabling the mapping of environmental experiences, daily behaviour practices and localised knowledge and ideas for spatial development. Direct planner involvement in its setup has ensured the relevance of the produced, 'soft' geocoded information. Maptionnaire allows anyone to create, publish and analyse map-based questionnaires with an editor tool. Allowing planners to design their own PPGIS tools independently is an essential step in building a bridge between PPGIS methodology and planning support systems (PSS) (cf. Kahila & Kyttä, 2009). The methodology is used both in research projects and in participatory planning practice-oriented projects, where various planning phases, various scales and various planning approaches have been involved.

The analysis for this paper was based primarily on the review of 203 participatory planning practice cases realised between 2014 and 2017. The data for this paper was not collected purposefully: the analysis is based on the study of realised public participation cases. In all of the studied cases, planners and other practitioners were themselves using the Maptionnaire tool. Thus, they defined which questions (including background questions) were asked from participants, and how the survey was designed.

The selection of cases covers those projects that have been clearly articulated being part of the formal and public urban and regional planning procedure with the minimum of 20 participants. The average length of these surveys was 6.4 pages and the average time that the survey was open was 164 days. The surveys included an average 33.7 questions, both map-based and traditional survey questions. Figure 1 presents a more detailed analysis of the used the survey question elements.

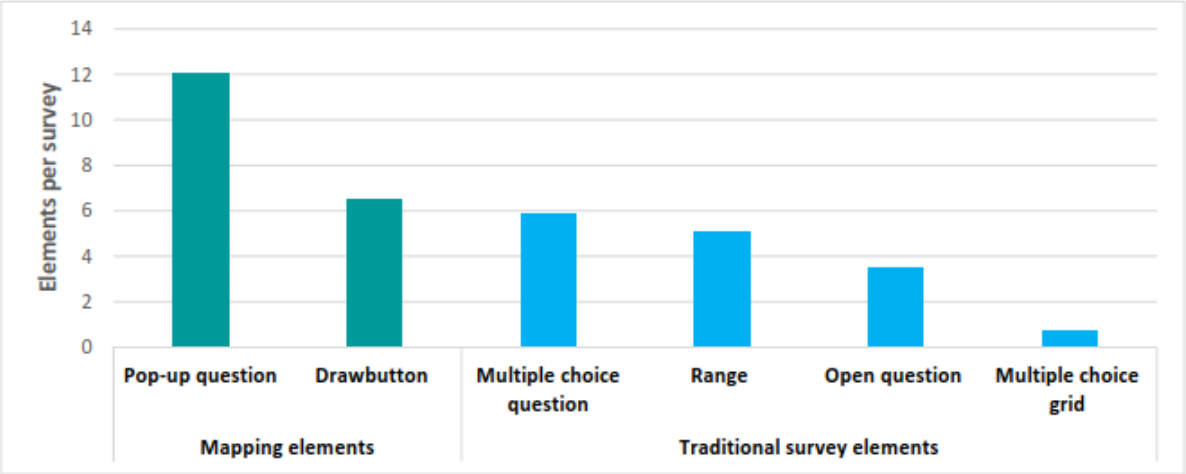

Figure 1 The types of map-based and traditional survey elements.

The cases were predominantly from Finland but nearly 40% of the surveys were from outside Finland. The main language of 62% of these surveys was Finnish, English was the second

common main language (30% surveys). The surveys in English were from US, Britain, Australia and New Zealand. 8% of the surveys were in Swedish, Dutch, Danish, Portuguese and German. In the majority of surveys (78%), only one language version was provided. In 19% of cases, two language version were available and in 2% three languages.

This pool of cases was complemented with a special review of the Maptionnaire projects among transportation planning by Mladenovic et al. (2017) (47 cases) and PPGIS projects studied in the doctoral dissertation of Kahila-Tani (2015) (28 cases). From the original empirical datasets of these studies, some comments by planners and other users of the Maptionnaire service, was included in the current analysis. These reflections were collected via email surveys after a PPGIS survey was implemented. Finally, a group of professional planners who attended the Metrix conference in Helsinki in 2017 identified the pros and cons of PPGIS tools. These comments were used as additional reflections concerning the final summaries of the analysis.

3. Results

In this chapter, we identify the pros and cons in using digital participatory planning methods and especially PPGIS methodology in addressing the three participatory planning challenges discussed above. Each challenge is critically reflected through the use of PPGIS tools in planning practice.

3.1. Effective arrangements of public participation

The planning sector has actively welcomed online PPGIS surveys as a new tool for participation. In Finland, most of the bigger cities already use PPGIS tools in planning and management. This mainstreaming is due to the perceived usability of online tools. A survey among transportation planners reveal that perceived usability was one of the most important reasons for the use of PPGIS (Mladenovic et al. 2017). As Maptionnaire allows the creation of online surveys with an easy-to-use interface, this perception is understandable. Technology remains a barrier to some users as are the monetary and human resources required. Presumably this explains low adoption levels in smaller cities. Even if online technologies demand less resources, high quality participatory processes cannot be created without investment. With our first PPGIS surveys in 2005, we expected that planners would probably prefer predeveloped sets of survey questions to collect knowledge from participants, with the standardisation of survey questions easing comparisons between settings. In practice, planners were not interested in this possibility and instead wanted to create their own surveys because individual cases and contexts were, they argued, unique.

The studied planning projects that used PPGIS vary in geographical scale stretching from nationwide surveys to those concerning single buildings (Table 2). Most cases were related to neighbourhoods while city/municipal level cases were also common.

Table 2. The geographical scale of the planning cases using PPGIS methodology.

Geographical scale	n	%
Neighbourhoods and blocks	85	42 %
Cities and municipalities	80	39 %
State and regions	29	14 %
Buildings	9	5 %
Total	203	100 %

Next, we analysed the types of projects where PPGIS tools had been utilised. Green and blue area planning and management projects together with transportation planning projects comprise over half (51%) of the cases (Table 3). Statutory master and regional planning cases as well as statutory detailed planning (Fig 2) cases are also very common, in total comprising 32% of the cases.

Table 3. Project topics among the planning and design cases using PPGIS methodology.

Project topics	n	%
Green and blue area planning and management	52	26 %
Transportation planning	51	25 %
Statutory detailed planning	39	19 %
Statutory master and regional plan	27	13 %
City development	18	9 %
Building design	9	4 %
Campus development	6	3 %
City branding	1	1 %
Total	203	100 %

Figure 2. Statutory detailed planning phase PPGIS survey of the city of Stockholm.

Participation becomes more effective if it takes place early enough in the planning process (cf. Friedman, 1992). In the Maptionnaire cases both extremes of the planning process stand out (Table 4). Early initiation has been the most common (49%) part of the process, but often (37%) PPGIS has also been applied in the evaluation phase. Within the evaluation phase projects we also included those cases that do not belong to a specific planning project but where the current settings are evaluated. The comparison of alternatives, decision-making and maintenance phases has had a minor role in PPGIS projects. In Finland the evaluation phase has thus far been rather neglected in terms of participation efforts. For this phase PPGIS tools can produce research results that test the successfulness of planning outcomes. Interestingly, Finnish legislation mandates that public hearings have to happen at least in the decision-making phase. This is often too late becoming the only phase of the planning process with some participation. The PPGIS approach seems to concentrate more on the other phases of the process and thus brings something new to public participation. Because all phases of the planning process are represented to some extent among the PPGIS cases, this suggests that PPGIS tools are flexible enough to accommodate the various forms of participation in different phases, which is showed in the following quotations:

> *Maptionnaire is a significant new service complementing more traditional participation methods. It allows the collection of opinions and wishes from stakeholders and their presentation in visual format. Because the data comes in GIS files, processing it is much easier. (GIS Analyst, Finland).*

> *The service has promoted a wider discourse in our city that is related to e.g. our participation and assessment programme that is under preparation. Transparency and openness have increased. (Communication Planner, Finland).*

348 **Table 4.** The planning phases where PPGIS methodology has been used.

The phase of the planning process	n	%
Initiation	99	49 %
Evaluation	75	37 %
Decision making	12	6 %
Comparison of alternatives	10	5 %
Maintenance	7	3 %
Total	203	100 %

349

350 Most studied PPGIS cases are led by city officials. Thus, we can argue that PPGIS
351 strengthens top-down participation while neglecting bottom-up or self-organised participation
352 modes. This critique is valid and can be related to a variety of issues including a lack of
353 financial resources by bottom-up groups. There are, nevertheless, a few cases where
354 grassroots actors have used the PPGIS tools without outside support, for example YIMBY
355 groups in Helsinki and Stockholm.

356

357 Instead of polarising top-down and bottom-up participation, it is also possible to build a
358 bridge between the two approaches. In some cases, PPGIS surveys have been co-created
359 together by city officials, residents and grassroots actors. This has happened for example in a
360 few planning projects in Finland where an issue caused conflicts among stakeholders. These
361 projects have usually taken place in relation to the re-use of existing parks or natural areas.
362 Where participants have been involved in the creation of the survey, they become committed
363 to participating in the survey after it has been launched and they have become eager to market
364 the survey through their own channels.

365

366 For effective participation to occur it is important to consider how the knowledge produced in
367 one planning project can support other projects. It is not uncommon that participants are
368 invited to participate in development projects in the same area several times. To address these

problems, the Finnish city of Lahti has archived PPGIS datasets into the city's GIS-system where every city official can access them. During the initiation phase of a new planning project, planners use this GIS-system to check what kinds of data have already been collected and what is required to complement already existing knowledge.

> *Being able to easily demonstrate current plans and potential outcomes of a project/investment overlaid on the map was an effective tool for getting rich feedback about how people perceive these changes. (Consultant, New Zealand)*

PPGIS tools can be misused, e.g. when planners want to emphasise new participation methods rather than a more effective and influential participation process.

> *The only advantage so far has been the 'image' benefit of implementing this kind of survey. To be able to use the content of the survey we have to deepen the analysis. (Planning director, Finland)*

This kind of token use is naturally possible for both digital and non-digital tools. Clearly, PPGIS tools alone do not make participatory planning better or more influential. Unfortunately, we have witnessed PPGIS projects where gathered data use was low (Kahila-Tani et al. 2015; Kahila-Tani, 2015). This may be a consequence of institutional barriers: public participation is still used to confirm political legitimacy and valued only as something that needs to be 'tick-boxed' during the planning process rather than concretely contributing to the results of the planning process.

3.2. Ability to reach a broad spectrum of people

Online, digital PPGIS tools can be useful in data collection from broader groups of participants and in reaching the 'silent majority'. Between 2014 and 2017, the 203 real-life Maptionnaire surveys reached altogether 94 757 participants, who mapped 286 703 points, lines and polygons. The average number of participants in each platform was 467. The

majority of surveys (29%) did not use incentives, only 5% did. In 29% of cases, this was not possible to track because the original survey was not online any more. We can conclude that PPGIS tools can reach a relatively large number of voluntary participants. These numbers of respondents do not, nevertheless, necessarily represent the wider population. If the sample is not representative or the response rates are low or unknown, one may still question whether the collected data represents the preferences and opinions of the 'silent majority' (Czepkiewicz et al. 2017).

> *Results match those of earlier smaller studies. Now we have a statistically more solid evidence that road is an issue at these places. We were surprised by the number of respondents from one particular neighborhood. We used this result to perform a follow up study. (Decision maker, Netherlands).*
>
> *Only challenge was with slight limitations with the tool and trying to get a suitable number of people to complete the survey. (Planner, US)*

The Maptionnaire surveys mainly (71%) encompass knowledge from residents. About 25% of cases were targeted to groups like decision makers, other project actors etc. In the future it is hoped for that wider expert groups, NGOs and associations affected by the planning project would be targeted more. Currently, only 4% of cases were targeted to these groups.

The Maptionnaire surveys show a varied representativeness. In some cases, socioeconomic and geographical representativeness has been good (Figure 3a; Laatikainen et al. 2015), in other cases it has been compromised (Figure 3b; Kahila-Tani et al, 2015). Some surveys have seen an overrepresentation of middle-aged women (Kyttä et al. 2011) others, young adults (Kahila-Tani et al, 2015). McLain et al (2017) found that analog community mapping workshops are likely to attract a different set of participants than online mapping surveys: Workshop participants were more likely than online participants to be men, somewhat older, and rural or small town residents. Representativeness can potentially be improved by offering

426 a paper survey in addition to online data collection (Czepkiewicz et al. 2017) or by arranging
427 data collection in public spaces or workshops, where assistance in using the PPGIS can be
428 rendered. This can also help overcome issues relating to poor map reading skills,
429 misunderstood questions and other common difficulties with map-based questions.
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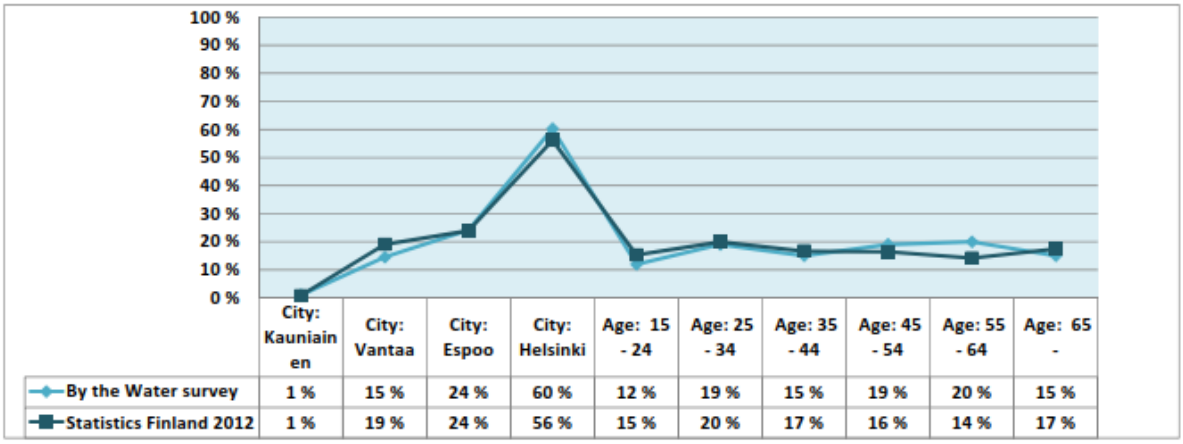

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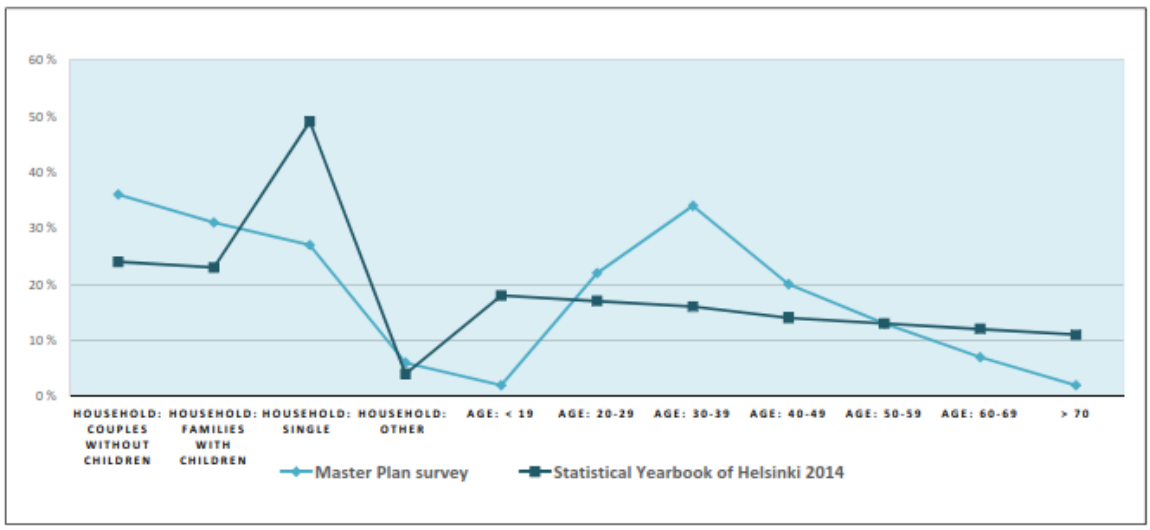
432 a)



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434 b)

435 **Figure 3.** The representativeness of the PPGIS surveys: (a) By the Water -survey in Helsinki
436 metropolitan area and (b) the Helsinki Master Plan -survey.
437

438 No clear pattern exists in respect of the PPGIS surveys attracting a certain profile of
439 respondent. Rather, it seems that the data collection strategy matters: large datasets and
440 personal invitations that are based on random sampling seem to promote good
441 representativeness while open marketing of surveys typically create problems in reaching a
442 balanced respondent profile. In participatory planning practice, random sampling is used very
443 rarely because it typically means sending personal invitations to participate via letters, which
444 is costly. Open marketing is used also because, according to the Finnish Land Use and
445 Building Act, efforts should be directed at reaching the public concerned. Therefore, cities
446 feel obliged to arrange openly marketed surveys instead of random sampling. One possibility
447 would be to realise both data collection strategies, collect two datasets and evaluate whether
448 the results significantly differ between the two datasets. Oulu region in Finland used this
449 strategy in their PPGIS project and found that the results of the two datasets did not really
450 differ.
451
452 PPGIS surveys may reach user groups that traditional methods miss. Children and young
453 people do not often take part in public hearings, which are dominated by older age groups.
454 Some cities, such as Lahti, have been successful in attracting children and young people to
455 participate in PPGIS surveys. On the other hand, ageing populations can be hard to reach
456 with online tools. In Finland, digital divide concerns affect the aged population while Internet
457 access is not related to class and status (Lindblom & Räsänen, 2017). Knowing this, Gottwald
458 et al. (2016) did a usability study among older adults and studied the cognitive, motor,
459 sensory and emotional challenges that older adults have when using the PPGIS application.
460 Based on the finding, the Maptionnaire service was developed further to make it more
461 suitable for ageing populations.
462

It is important that we have been able to provide a channel for participation to those who do not typically come to the events we arrange. The next challenge is to be able to show the influentiality of the realised survey. (Master Planner, Finland)

One advantage of online surveys is the possibility of providing multi-language versions, making it possible to reach immigrants and minority language groups who are not typically well represented in traditional public participation processes (Fig 4). Some surveys have been successful in reaching minority language groups, like non-dominant language speaking inhabitants.

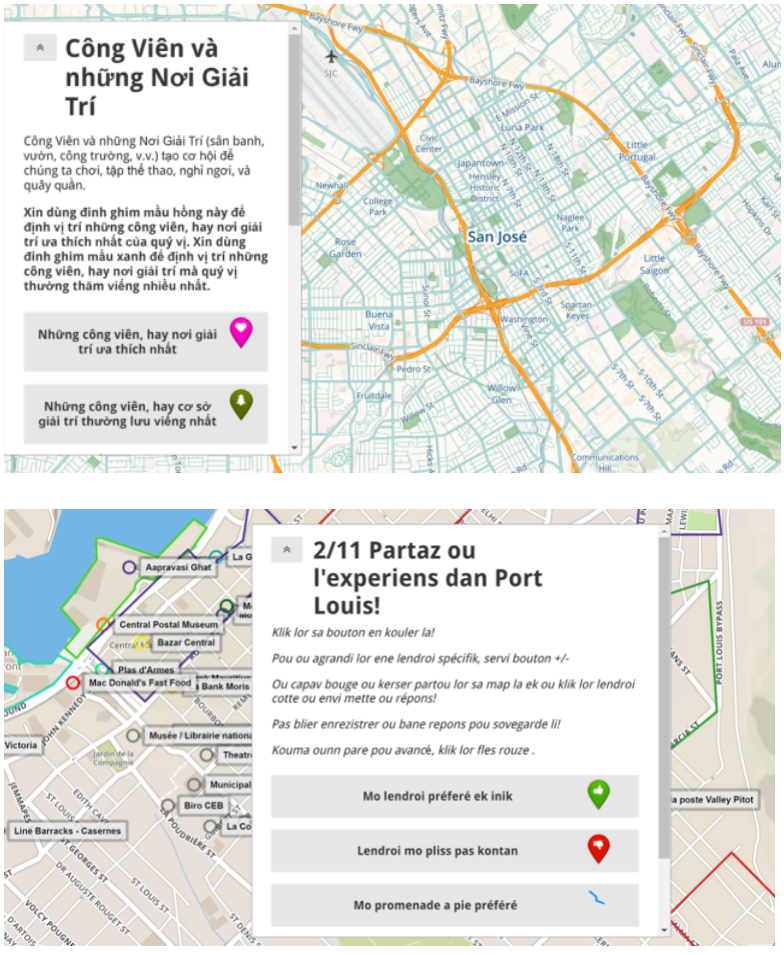


Figure 4. PPGIS surveys in Vietnamese (above) and Creole (below).

Respondent accessibility is promoted by the usability, visual appearance and scaling of the PPGIS tool from mobile devices to laptops. For service users, numerous customisation options exist, including the possibility to set branching rules for the survey. This means that surveys can be built that respond dynamically to the answers a respondent has given. This feature has proved powerful in reaching different respondent groups. In the City of Espoo (Suurpelto) the branching rule was used to reach current residents, potential new residents interested in the area, local service providers and companies potentially interested in relocating to this area and each group answered a specific set of questions.

PPGIS becomes powerful when it reaches different kinds of people obtaining different insights, experiences, values and ideas. With map visualisations it is possible to concretely highlight disagreements between different groups. For example, in the Helsinki Master Plan case (Kahila-Tani et al. 2015), conflicting views were shown on a map concerning where to locate new buildings and which areas should be protected from new infill projects. Instead of avoiding the contradictions, conflicting views can be made visible and this analysis may be used to learn where deeper collaboration and deliberative actions are required. To create participation which is as pluralistic and extensive as possible, online PPGIS survey participation must be complemented with other engagement possibilities.

4.3 *Production of high quality and versatile knowledge*

PPGIS allows the collection of versatile knowledge: both qualitative and quantitative data; map-based and traditional survey data; scientific data and comment-data. Data quality can thus be a complex issue often depending on the ways in which tools were used. The production of respondent data faces similar challenges to those encountered by all surveys,

but additionally some challenges related to online mapping. In this chapter we discuss both traditional and PPGIS specific challenges, while focusing on the latter.

Although the purpose of the data collected by planners is not always to fully meet the scientific validity and reliability criteria, PPGIS datasets have to be reliable and concerns relating to data quality remain. Below, we summarise evidence on (1) the ways planners apply PPGIS tools, (2) the data quality produced by respondents, as well as (3) the technical aspects and (4) the analytical procedures influencing PPGIS data quality.

To evaluate planner's skills to create PPGIS surveys, we looked at how planners used the PPGIS survey elements and compared them to surveys created in research projects. We found that the length of surveys or the ways in which survey elements were used did not differ significantly between planners and researchers. Planners' surveys were slightly shorter with fewer elements, but they used the possibilities of the Maptionnaire service in at least as versatile ways as researchers. Shorter surveys are justifiable because real-life participatory planning surveys do not aspire to the same depth as research surveys.

Concerning the data quality produced by respondents we argue that accuracy is important at least where planners seek feedback about specific planning solutions or improvement ideas for an area. However, can people pinpoint their meaningful places accurately on digital maps? While PPGIS surveys typically include questions about people's experiences and preferences, answers do not always pertain to well-defined geographical objects, and therefore cannot be evaluated and compared against any standard (Czepkiewicz et al. 2017).

526 Spatial accuracy was studied by Hazansadeh & Laatikainen (2017) with a PPGIS dataset
527 based on aging population, who presumably face greater difficulty in mapping than other user
528 groups. When home location markings were compared to the actual home coordinates, it was
529 found that 86.8% of markings had an average error distance smaller than 100m and 75.1%
530 smaller than 50m. It is noteworthy, that in PPGIS projects related to planning processes,
531 home locations are not often collected. Although the marking of home is not, by definition,
532 personal data, the users' privacy typically prevent planners from collecting this kind of data.
533 The reported study was a research project. The previous finding can be compared to the
534 results of Brown et al (2015) who found that 70% of PPGIS points that identified
535 biological/conservation values were spatially coincident with modelled areas of high
536 conservation importance. These levels of accuracy are probably satisfactory in most planning
537 cases. Nevertheless, Maptionnaire services also include the possibility to use an address
538 finder, which can be an important functionality to increase location accuracy.
539
540 Another way to evaluate PPGIS data quality is to assess the mapping effort - the frequency of
541 mappings - as a proxy for data quality. Brown (2017) found that the mapping effort depends
542 on the relevance of the survey topic to the respondent, recruitment technique, spatial
543 discounting and compensation but according to Czepkiewicz et al. (2017) the frequency of
544 markings alone does not guarantee high data quality. In our sample, the number of mappings
545 per survey was, on average 1412, 7.0 mappings per participant. We find this an adequate
546 effort. In comparison, in research projects participants mapped, on average, 9.1 points.
547
548 The Maptionnaire tool provides some technical ways to increase data quality. For example,
549 by randomising the order of item lists, the influence of a preselected order can be avoided. In
550 PPGIS surveys, participation is typically anonymous. The advantages and disadvantages of

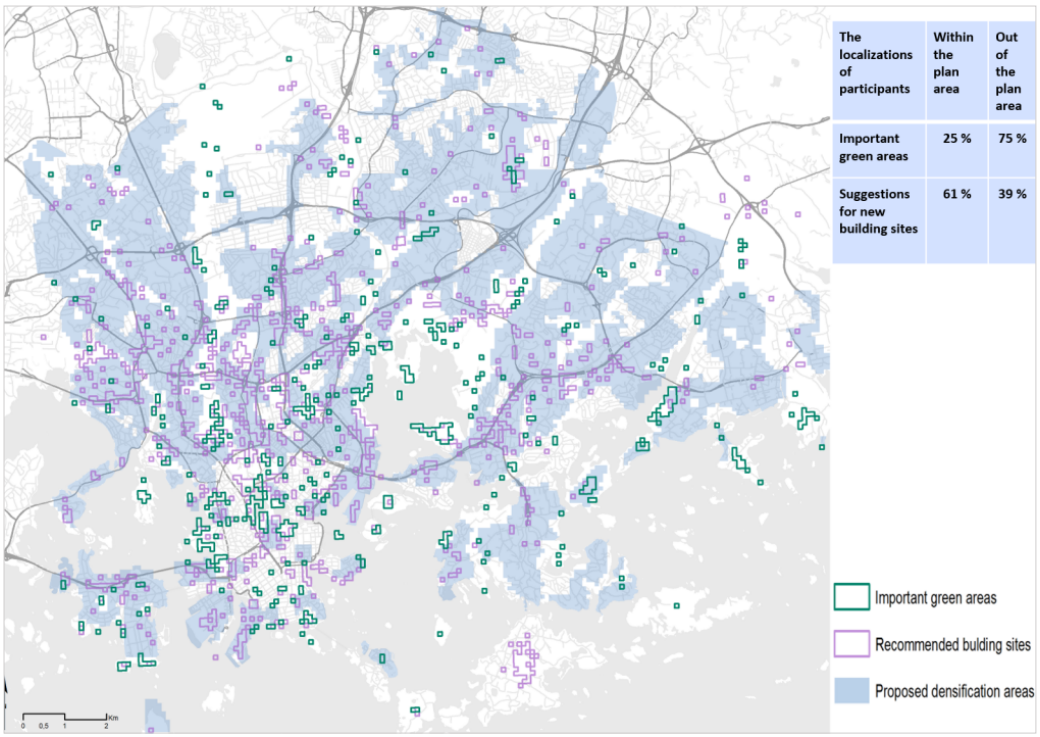
anonymity have been well documented (Christopherson, 2007). Compared to traditional collective participation, the opportunity to provide individual views anonymously may increase equality, diversity and the reliability of individual views especially when respondents do not see others' responses. Data manipulation is also less tempting if the respondents cannot see others' responses. The functionality of showing or hiding the responses of others is optional in the Maptionnaire tool. In 78% of real-life planning cases, PPGIS respondents did not see the answers of others.

Analysing PPGIS datasets can be a true challenge, even for planning practitioners. Besides analytical complexity there is also the temptation of cherry-picking pieces of information or evidence that are politically most welcome (Krizek et al., 2009; Kahila-Tani et al, 2015). The cherry-picking phenomenon cannot be totally avoided, as the data processing in planning projects takes always place in sequences of human interaction. It can be partly avoided by analysing the data properly and thoroughly by an expert or by opening the data for the public. One unique possibility that the PPGIS approach provides is the simultaneous analysis of the 'soft', experiential place-based datasets with the 'hard', traditional GIS datasets. Here, planners can potentially gain knowledge about the experiential dimensions related to urban structural characteristics, land use patterns, zoning etc.

> *To be able to map the most loved coastal areas and their diverse uses is an amazing new possibility. We can combine large-scale areal analysis with subtle local knowledge and qualitative knowledge to the structural characteristics of the place. This leads to new interpretations. (Researcher, Australia)*

Answering questions like what level of urban density is perceived most positively by inhabitants (Kyttä et al 2016) allows the use of PPGIS as a diagnostic tool in participatory planning (Horelli, 2002). These opportunities for deeper data analysis are, however, rarely used by planners. Another, advanced analysis possibility concerns the influentiality of public

578 participation. In the Helsinki Master Plan case, the future view of PPGIS survey participants
579 was compiled on a map and compared to the plan proposal (Fig 5) and to the final plan via a
580 compatibility analysis (Kyttä et al, 2018). These kinds of deeper analysis are potentially very
581 beneficial and bring along new dimensions to public participation.
582
583 If a participatory planning project utilising PPGIS methodology is designed to attain genuine
584 collaboration, the data analysis phase should be collaboratively realised. In some PPGIS
585 cases, residents have been invited to interpret and analyse the collected data in a workshop
586 setting. In Helsinki's Master Planning project, the PPGIS data was published online, used in
587 public meetings and workshops while a Hackaton summit was also organised for data
588 analysis and visualisation (Kahila-Tani et al, 2015). Some challenges arose: the workshop
589 participants were sometimes more eager to air their own opinions than to study and rely on
590 the already produced insights of PPGIS participants. In addition, cases exist where the PPGIS
591 data collection has taken place in a workshop, larger venue or a fair. Here the planners have
592 acknowledged the possibility of having a dialogue simultaneously with the participants
593 related to the planning topic using PPGIS to approach people.
594



595

596 **Figure 5.** The future viewed by PPGIS as compared to the Master plan proposal of the city
597 of Helsinki.

598

599 Planners have often welcomed PPGIS because of the abundance of positive feedback
600 received. Typically, in PPGIS surveys the positive place-based comments dominate. For
601 example, in a large PPGIS survey in the Helsinki metropolitan area on the perceived positive
602 and negative quality of the environment, 63% of comments were positive (Kyttä et al. 2013).
603 This is an unexpected result for planners who are used to receive generally negative feedback
604 in a typical public participation process. Evidently PPGIS data can be connected to specific
605 planning or design solutions and can potentially provide influential and usable information
606 for urban planners. At best, participant knowledge can be more equally recognised parallel to
607 other data sets used in a planning project.

608

609

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4. Discussion

This article explored the advantages and disadvantages of using PPGIS tools in urban and regional planning. Over 200 public participation projects were analysed from three perspectives: 1) effective arrangements of public participation, 2) ability to reach a broad spectrum of people and 3) the production of high quality and versatile knowledge. The summarized results based on these reflections are presented in Table 5.

Our review revealed that PPGIS methods had been successfully used in various scales and in different phases of the planning project. So far, PPGIS methods have been applied mostly in the beginning and in the end, in the initiation and in the evaluation phases of the planning process. Although best practises are needed how to deploy PPGIS also in other phases, it is possible that carefully implemented participation in the early phases of a project could reduce the need for participation in the later phases – the early adaptation of participation inherently produces trust among different partners.

In the reviewed cases, planners themselves were typically the initiators of PPGIS methods, sometimes other public sector actors and seldom other groups like grassroot actors. Thus, there is a danger that the use of PPGIS leads to the continuation of top-down participation. Currently especially committed, reformist planners are needed to guide the usage of new digital tools like PPGIS and to exploit the collected knowledge. We agree with Staffans (2004), who notes, that public participation should focus on the creation of new knowledge and be innovative while raising the experiential knowledge of local people to a focal position. Continuity is key here enabling the building of trust, feeding both the democratic and innovative objectives of planning (Staffans, 2004). Recent studies show that planning actors

require planning support systems (PSS) that can be easily adapted to changing project demands in easy to understand formats (Champlin et al., 2018). PPGIS has proved to be a tool that is flexible enough in adjusting to various planning demands - when used systematically in various planning tasks it can evolve into a more stable participatory planning support system (Kahila-Tani, 2016).

PPGIS tools seem to help broadening public participation and bringing along new groups of participants. PPGIS has the transformative power to value the voice of difference by emphasising the varying opinions available locally (Brown & Kyttä, 2014) and by allowing larger groups of people to answer a question or seek a solution together (Surowiecki, 2004). The challenges of online participation include e.g. digital divide and issues related to representativeness. Our study identified similar challenges in representativeness than the earlier studies by Brown and Kyttä (2014) and by Czepkiewicz et al (2017) pointed out: especially when volunteers produce PPGIS data, serious issues with representativeness typically occur. In terms of data quality and usability, the localized PPGIS data can provide direct feedback about planning solutions and be integrated with existing GIS systems. This can help recognising the user knowledge more equally with other datasets. There is, however, no guarantee that PPGIS data would be more influential than knowledge produced in more traditional public participation processes. Especially when the planning problem is sensitive, a greater level of attention should be placed on data collection strategies to increase PPGIS data reliability and validity. The collected data should be opened to participants and jointly analysed and debated in a deliberate process.

661 **Table 5.** The potential pros and cons of PPGIS to promote public participation.

662

PROS	CONS
PPGIS & the effective arrangements of public participation	
• Easy to implement by planners, residents or other actors * • Data collection in various geographic scales • Usable in various phases of the process and in different planning situations • Systematic data collection reduces unnecessary data collection • **Data can be used by various sectors**	• Leads easily to the continuation of top-down participation • Can take the form of non-meaningful participation • Lack of economic resources, skills, interests etc., can prevent use of digital methods • Digital methods alone are seldom sufficient* • Does not solve all the challenges of public participation* • **Strategic level questions difficult to answer without face-to face discussions**
PPGIS & the ability to reach a broad spectrum of people	
• Relatively high number of participants can be reached with reasonable effort* • Reaching new resident groups* • Fostering individual participation • Reveals residents' conflicting viewpoints of the planning topic	• Digital divide • Technical challenges • Data manipulation • Anonymity • Challenges related to data collection strategies • Technology stress & information overflow • Poor geographical and socio-economic representativeness* • How to involve also other stakeholders like NGOs? • **Biased results can be a potential danger**
PPGIS & the production of high quality and versatile knowledge	
• Localized information related to planning situations* • High-quality, versatile data • Allow the collection of positive feedback • Place-based data can be integrated to existing systems* • Knowledge from participants can be more equally recognised parallel to other more formal data sets • Results easier to process and analyse using various approaches* • Data can be processed further in deliberative processes among the residents and other stakeholders • **Getting answers to certain topics relevant in the planning process**	• Methodological challenges • Potential of cherry picking - misuse of data to support e.g. the existing presumptions • Potentially lack of transparency • **More influential participation is needed - can PPGIS really help?** • **Frustration of participants if nothing changes** • **Illusion of influentiality - democracy does not always work in politics**

663 Note: Comments marked with * were also mentioned by Metrex conference members. Statements written **in**
664 **bold** were identified only by Metrex conference members.
665
666

When summarising the possibilities and limitations that different PPGIS tools can have, we should acknowledge, that participatory planning projects cannot be put into a single 'mould' but should rather be viewed in the context where different views, actors, tools and ideas are emphasized. Therefore, the identified potential advantages and disadvantages are highly context-dependent, valid in one situation but invalid in another. Carver et al. (2001) suggest that the particular local context plays an important role in shaping participatory approaches to spatial decision-making. Also in the studied PPGIS projects, we clearly witness the differences in the approaches that stem from the character of local projects. The local efforts support the notion that pragmatic motivations are required to promote more inclusive planning processes, reaching decisions that reflect on the outcomes of the feedback received from stakeholders (c.f. Reed et al. 2008). Normative motivations cannot be neglected either. Clearly some of the reasons justifying the right of participation identified by Innes (2004) can be confirmed by PPGIS. More work is however required to create systems that render the processes more transparent while advancing fairness and justice in participation. New development work around PPGIS tools should concentrate on this challenge by enabling integration of the knowledge received to open systems up to lay people. This would also develop individual participation further while facilitating collective social learning.

The impossibility of a planning practice environment where all interests can equally engage in open dialogue and deliberation is generally acknowledged. Therefore, participation should be more profoundly established through methods designed to directly address topical questions during the ongoing planning phase. A variety of participation tools are needed (Staffans & Horelli, 2014) that better encompass various planning interests and avoid encouraging elitist-based participation focusing on those who are willing and able to use

692 power over others. As such, the implementation of participatory actions demands greater
693 systematic and strategic thinking to produce a more effective and fair planning process.
694
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