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PPGIS and Public meetings – An evaluation of public participation methods for urban planning

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Abstract

The primary purpose of this study is to compare and evaluate two public participation methods. The two methods are public meetings and Public participatory GIS (PPGIS). Public meetings are an established public participation method for urban planning in Sweden. The thesis aims to test the hypothesis if PPGIS is more effective as a public participation method.

The thesis first evaluated the two methods with the help of a framework for evaluating participation methods. The framework defined what effective participation methods were. An effective public participation method was assumed to gather high volumes of data for planners to use and be representative of the respondents. Other key factors for efficiency were cost-effectiveness, independence of respondents and influence of comments on decisions-making. A GIS-analysis to demonstrate the possibilities of a PPGIS was also conducted. Data for this study were gathered with the help of City of Helsingborg.

The results suggest that the hypothesis could not be rejected. It was concluded that PPGIS is a more effective participation method, however a combination of both methods would further benefit the public participation.

Key words: GIS, Geography, PPGIS, public participation, public meetings, planning decisions support system.

Swedish abstract

Den här studiens primära syfte är att jämföra och utvärdera två medborgardialogsmethoder. DE två metoderna är samrådsmöten och Public participatioru GIS (PPGIS). Samrådsmöten är en etablerad metod inom medborgardialog för samhällsplanering i Sverige. Uppsatser syftar till att pröva hypotesen om PPGIS är en effektivare metods för meborgardialog.

Uppsatsen utvärderade först de två metoderna med hjälp av ett ramverk för utvärdering av medborgardialogs metoder. Ramverket definiereade var effektiva medborgardialogsmetoder var. En effektiv medboragdialogsmetod antogs vara en metod som samlade stora mängder data från meborgarna samt vara en representativ metod för respondenterna. Andra viktiga faktorer för effektivitet var kostnadseffektivitet, självständighet för respondeter och dialogens inverkan på beslutsfattande. En GIS-analysis för att visa på möjligheterna av ett PPGIS genomfördes också. Data för denna studien samlades in med hjälp från Helsingborgs stad.

Resultaten visade att hpotesen kunde inte avböjas. Slutsasen drogs att PPGIS är en mer effektiv medborgardialogsemtod. Däremot, en kombination av båda metodena kan ytterligare gagna medboragrdialogen.

Nyckelord: GIS, Geografi, PPGIS, medborgardialog, samrådsmöten, stödsystem för planeringsbeslut.

Wordlist

National Planning and Building Agency (in Swedish: Boverket)

The National Planning and Building Agency is the agency responsible for the Planning and Building Act and its application on the planning in municipalities. It sets the recommendation and rules for the municipalities to work with.

Stadsplan 2017

Stadsplan 2017 is an addition to the Master Plan from 2010 for the city of Helsingborg. Its consultation period span between 23rd of June and 23rd of September 2016. During this period, an internet-published PPGIS have been used as one of the participation methods. Other methods have been public meetings and other types of public opinion surveys. The GGIS data collected through the main PPGIS consultations for Stadsplan 2017 are, in this thesis, referred to as consultation dataset. It contains 158 unique entries.

Tyck om Helsingborg (in the thesis referred to as Pre-consultation)

Tyck om Helsingborg was a PPGIS project to gather opinions from citizens regarding the city. Conducted during spring of 2016, it served as an early dialogue with citizens in preparation for Stadsplan 2017. It resulted in 1250 unique entries.

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Abbreviations

PSS – Planning Support System

PPGIS – Public Participatory Geographic Information Systems

NIMBY – Not In My Backyard (or Not in my backyard-syndrome)

ÖP 2010 - Översiktsplan 2010 (Master Plan for Helsingborg)

SCB – Sweden Statistics

1. Introduction

Democratic values and procedures are a vital part of the planning processes of the city. In Sweden, the process is bound-by-law to allow all involved citizens to express their opinions and comments regarding plans. Helsingborg, which serves as a spatial extent for this thesis, is a city in southern Sweden with over 140,000 citizens. Such as every other city in Sweden, it is bound by law to allow all involved individuals to express their opinion regarding planning processes. This has primarily been done by holding public meeting and hearings.

Public meetings aim to invite all interested people to a certain place at a certain time, potentially on several occasions, during which formal opinions are requested by the officials. The consultations are a part of a planning-process that results in a land-use plan. A land-use plan regulates which land-uses are allowed, and to what extent, over the specific area. All citizens that are directly affected of the land-use plan, who are selected based on if and how the plan affects them and their home, are also given a formal opportunity to send their opinions, comments or declaration of no objections for the land-use plan to be accepted (Boverket, 2017). However, such processes are not always sufficient. There are limitations regarding who can (or will) attend such meetings, or who speaks at such meetings. An alternative to public meetings is PPGIS. PPGIS is a consultation method where participants, using maps, leave comments connected to a certain area (Shuurman, 2008). This can be done by e.g. internet-hosted maps, which has been the case in the studied example of Helsingborg.

1.1 Purpose of the study

The purpose of the thesis is to study and evaluate the efficiency of public meetings and PPGIS as methods for public participation regarding urban planning. The thesis aims to test the hypothesis that PPGIS based public consultations are more effective than traditional methods, such as meetings with the public also in Swedish conditions, with a case-study on city of Helsingborg. The efficiency of the two chosen methods is a result based on measured representativeness of the methods amongst citizens, independent of true participants, influence on final policy, transparency of process to the public, structured decision-making and cost-effectiveness.

The efficiencies of the two methods are tested by using a framework to create a structured method to measure and compare different public participation methods and by showing an example of the potential of GIS-analyses in helping the planners making decisions regarding what areas in the city need to be revitalized. In the context of this thesis, efficiency means how democratic values are met within the methods (using measurements on participant's volumes and diversity, actual influence on planning decisions, and independence of participants) cost-effectiveness of the participation projects and advantages for planners in their decision-making. It is not the purpose of this thesis to compare all possible types of public meetings or PPGIS. Instead, the purpose is to compare an approach to public meetings where citizens are invited and share their thoughts through discussions, and a PPGIS model employed in Helsingborg.

Furthermore, the thesis attempts to show examples of possible GIS-analyses on PPGIS-collected data from two consultation processes, originating from Helsingborg. The purpose of the GIS analyses is to give planners statistically grounded answers to what areas are in need of revitalisation.

1.1.1 Research questions

I have identified three research questions which the thesis will attempt to answer. These are:

Is PPGIS a more effective method for urban land-use planning regarding collecting opinions from the citizens, compared to traditional public participation methods?

Is PPGIS a more effective method for urban land-use planning for decision support for new housing establishments, compared to traditional public participation methods?

What areas of Helsingborg are in in most urgent need of revitalisation, according to the citizens?

The first two questions are an evaluation of PPGIS to address what advantages and disadvantages PPGIS carries. The Framework of evaluation, by Rowe and Frewer (2000) is used as a base for the evaluation of PPGIS and traditional participation methods. The thesis is not limited to the citizen's perspective, as it also includes the perspectives of the officials. In the case of the officials, I have chosen to focus on the housing situation in the city. Lastly, the

third question attempts to illustrate the advantages GIS-analyses gives, as data gathered from PPGIS suits such analyses. GIS-data have a specified location (i.e. all entries are located somewhere on the map) and all the pieces of data have values connected to them. In this case, a positive (e.g. points which citizens marked as a “Clever idea” or “This area is good) and a negative (e.g. “Bad idea” or “This area needs improvement”) are attributes of interest. Using GIS-analyses, positive and negative opinions can be mapped for planners to use in urban planning.

1.2 Structure

The thesis is structured into five different chapters. The introduction is the first chapter and its purpose is to introduce the subject of the thesis and the characteristics of the study area.

Following the introduction, Chapter 2 gives the historical, geographical and theoretical background of the subject. The historical and geographical background refers to Helsingborg, as this is the extent of the study. The theoretical background concludes the background with Arnstein’s (2016) ladder of participation.

Chapter 3 is a methodological chapter, which describes the methods used for collecting the data and the methods behind the GIS-analysis, as well as it presents the framework for evaluating the participation methods.

Chapter 4 presents the results found using the methods from Chapter 3. The first part presents the GIS-analyses and the second part is based on the framework for evaluation.

Lastly, Chapter 5 discusses and concludes the thesis with discussions regarding the results.

2. Background

2.1 Historical and geographical background

The case-study is based on Helsingborg. Helsingborg is a city located on the western coast of Scania, the southernmost province of Sweden. It got approximately 140,000 citizens. It is a diverse city with both large so-called million programme areas (which are areas with mainly flats, built during the 1950's and the 1960's), as well as typical singe family dwellings. Along with the city, several smaller villages are within the jurisdiction of the city council, which forms the entire municipality (see Figure 1). The responsibility for the planning of the city is entirely on the city council and more specifically on the city planning office. The first plans of the city, still legally binding, are dated to late 19th century (Helsingborgs stads statistikdatabas, 2017).

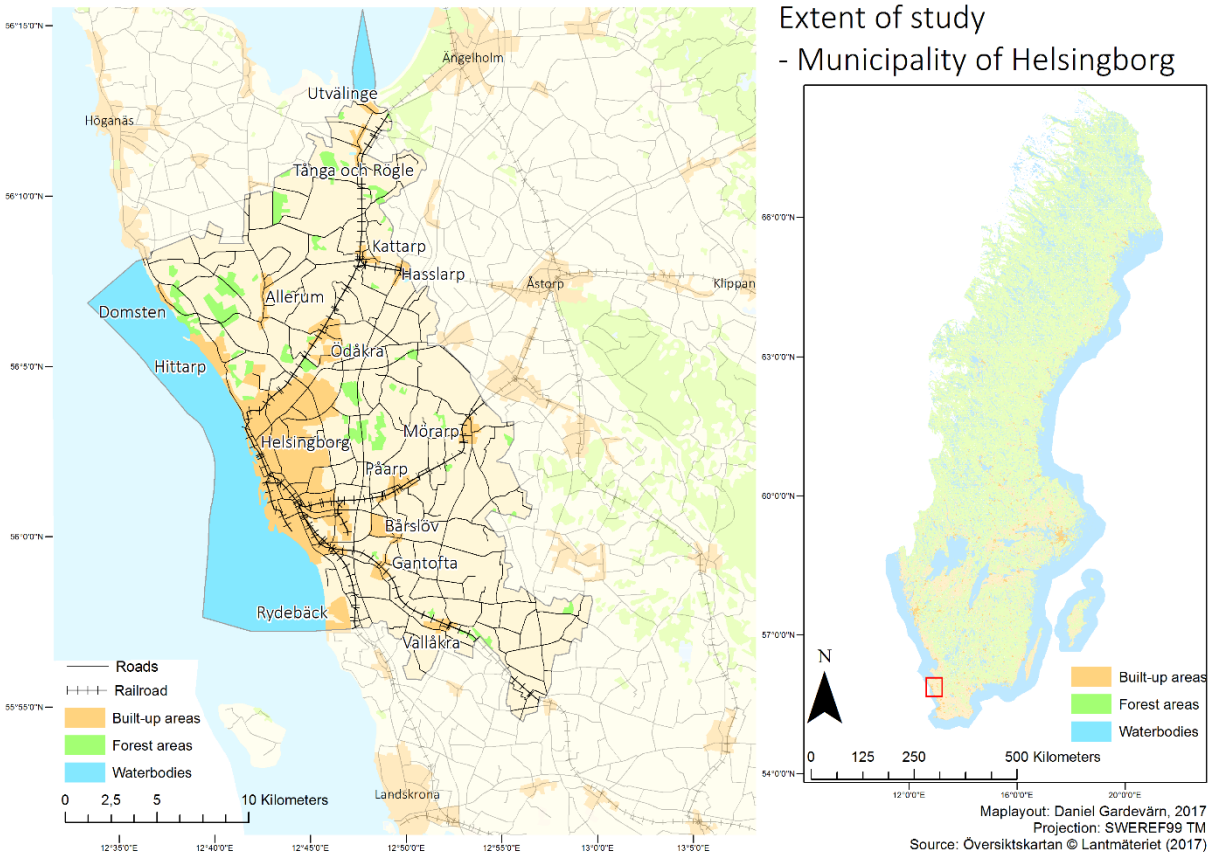

Figure 1 - Extent of the study, Source: Lantmäteriet, 2017

Despite formal planning being a rather old tradition, any need for public consultation was not addressed legally until the introduction of the Planning and Building Act in 1987, as an attempt to avoid land-use conflicts between citizens and the city and to provide a foundation

for a more democratic process. One of the major changes within public consultation was the fact that supervisory control of the plans by the state was abandoned, in favour of including the public in the planning process. The supervisory control meant that all land-use plans created in Sweden were checked by the state before being legalized. City plans were not only forced through a bureaucratic system, but also anchored and legitimized amongst citizens. The Planning and Building Act of 2010 replaces the act of 1987. The revision of the Planning and Building Act emphasized a further developed inclusion of citizens in the planning process. Furthermore, a revision of the Planning and Building act from 2010 was legalized in 2015. This revision required a quicker and more effective process of creating plans. However, most importantly the latest version required a more rapid inclusion of the citizens in the planning process (Hansson and Ingemansson, 2015).

2.2 Public participation

2.2.1 What is public participation?

Public participation is, at its most basic, concerned with the amount of influence that non-governmental stakeholders, such as the public, have on the governmental decision-making at different scales. Its purpose is to allow governmental decisions to reflect the public's need in, for instance, urban planning, and to distribute the benefits more equitably. Underlying this, it attempts to address uneven power relations among citizens, and between citizens, elected officials, and planning professionals (Radil and Jiao, 2015).

To understand public participation, an understanding of the words "public" and "participation" is essential. The term "public" in this case, is everyone possibly involved in the process. It can be decisions makers, implementers, affected individuals or interested individuals. The term "participation" refers to the process of the public passively receiving information, and using this information to gain control of the decision process (Brown, 2012).

2.2.2 Public participation praxis in Sweden

The Swedish National Board of Housing, Building and Planning, *Boverket*, emphasizes the importance of an effective inclusion of the citizen's opinions and knowledge both in the

revised Planning and Building act from 2015, and in their document *Det lönar sig att börja tidigt* (eng. *An early start is beneficial*, authors own translation). Boverket implies that a quick and early start in consulting the public is desired, as it later can improve and shorten the entire planning process. If the public is included in the early stages, the chance of getting their will through increases, as well as the planner will be provided with more detailed material for the process (Hansson and Ingemansson, 2015). The traditional process of public consultations includes meetings with the public or, in case of proposals for larger plans, events at which officials from the municipality attend and present the plan. Apart from this, the plans can be published through channels easily accessible to the public, such as the internet-pages of the city council or the local newspaper. For most plans, printing and exhibiting the plans at the city council building are also a part of the consultation and is required by law. The periods when the public can express their opinion, and expecting a formal answer, varies. In most cases, one month is a standard. However, due to e.g. holidays, this time can be extended. In other cases, if the consultations require a larger plan, the time window for consultations may be open several times (Boverket, 2017).

Issues with representativeness

The questions of justice, equity, participation and influence are questions that have been a part of democracy dialogues regarding urban planning. It is important that everyone should be allowed to participate in the consultations on equal conditions, where every citizen who wants to express their opinion should have the opportunity to do so. Furthermore, everyone should be able to do this with no affection from other bodies (such as other citizens, officials or sponsoring bodies). For a democratic process to be legitimate, everyone needs to be able to be represented (Hansson and Ingemansson, 2012).

The traditional public consultation grapples with several issues regarding representativeness in the participation process. For example, planners from several municipalities in southern Sweden described the process as being uneven, regarding who participates. One of the main reasons is that is it very hard to reach out to a wide group of the public. Another issue, related to the first, is that the certain groups are impossible to attract to the consultation meetings (Hansson and Ingemansson, 2015). Examples of such groups are families with children and youth (Andréasson, in Hansson and Ingemansson, 2015). Shortage of time and socio-

economic factors are the two main factors behind these patterns. (Hansson and Ingemansson, 2015). The city of Helsingborg, which was not a part of the Hansson and Ingemansson study, is also experiencing similar patterns connected to their consultation meetings. Men, aged over 65, are those who attend most meetings. They are also those who are heard the most in the processes of, for instance, master plans in Helsingborg during the last years (Pettersson, 2017).

2.2.3 What is PPGIS?

PPGIS is a method that seeks to engage the public in participatory processes by using geospatial technology for decisions that have spatial implications. Decisions that have spatial implications are decisions that affect certain areas, as opposed to others. Some examples are decisions that affect e.g. national parks, wilderness areas or urban parks. There are several ways that PPGIS can be implemented. For example, participants can be encouraged to identify locations on a map, by applying values, such as their subjective opinion for an area they pick on a map (Brown, 2012). In the case of Helsingborg, citizens were asked to leave a comment for a certain area they picked by clicking on a map. The comment was left along with a mandatory question to answer whether the area had “Qualities” or “Needed improvement”. This can either be done on a digital map or on a hardcopy map. To reach out to the citizens, household sampling, e-mails, on-site contact or workshops can be employed. The PPGIS process may both include pre-existing data (such as physical and social data) and participatory data, where the data have been collected from the public (Brown, 2012).

The Master Plan of Helsinki, similarly to the Stadsplan 2017 of the City of Helsingborg, used a PPGIS process. The participation process was based in connection to a PPGIS survey, containing two interactive maps. The maps contained spatial markers for users, questions regarding user background and their attitude towards urban development (Kahila-Tani et.al. 2015).

Helsinki Master plan employed other public participation methods as well, such as seminars, workshops, displays at the City Planning Fair, surveys and meetings. The core of the PPGIS component of public participation, such as master plan of Helsinki and Stadsplan 2017 of City of Helsingborg consists of an interactive tool, often published on the internet. This interactive

tool allows users (e.g. citizens) to browse maps and leave comments on the maps. Apart from leaving comments, some questions can (but do not necessarily need to) be asked by the planner regarding the users background or the city. Such questions were not available in Stadsplan 2017. These interactive map tools are a service open during a limited amount of time (often correlated with time of public consultation for the plan it regards) (Kahila-Tani, et.al., 2015).

To be able to understand and process the PPGIS data effectively, the planners should be a major part in creating the tool and bridging a gap between PPGIS methods and a PSS. Furthermore, the analysis tools of GIS can give the planners the possibility of a quick study of the results in terms of spatial distribution (such as clusters of points with citizen's opinions) or content in the answers to open-ended questions with the possibility of commenting on the maps. Visualization tools available through GIS, but also the possibility to incorporate into the interactive PPGIS-tools (which was the case in Master Plan of Helsinki), can facilitate face-to-face discussions at workshops or exhibitions (Kahila-Tani, et.al., 2015).

2.3 Theoretical background

It is of the utmost importance for municipalities to involve their citizens into consultation processes. Not only is it bound by law, but the sponsors and organisations profit from more data and perspectives. Furthermore, it is also a question of democratic values, whether all citizens are equally treated during a consultation process. One of the most eminent frameworks regarding the public is *Ladder of participation,* by Arnstein (Arnstein, in LeGates and Stout, 2016). It consists of several stages of participation, described as a ladder of eight steps. Figure 2 describes the different steps of participation, along with the idea of benefits granted by everyone's participation.

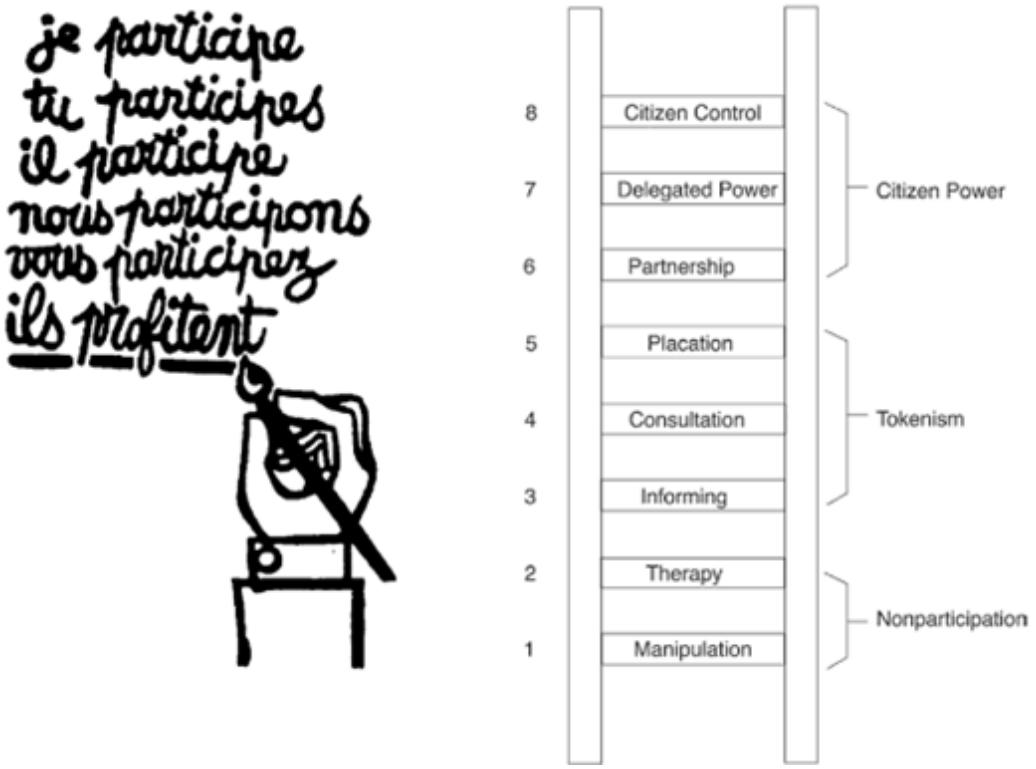

Figure *2* - On the left side of the figure, a French student poster stating in French: *I participate, you participate, he participates, we participate, you participate, they profit.*, on the right side of the figure, the eight steps of Arnsteins participation ladder, (LeGates and Stout: 2016)

The idea behind the steps on the ladder, is to classify communities based on their methods of participation. The ladder's first two steps are non-participation, as citizens in communities placed on these two steps are non-participants. The ideas of the powerholders in these two steps are not to let citizens participate. Instead, *educating* citizens or *curing* their inability to express their opinions, as they might be incorrect, is a goal with these steps (Arnstein, in LeGates and Stout, 2016).

Following the steps of non-participation, which are the first two steps, comes three steps of, what Arnstein refers to as *Tokenism* steps. These steps are a great leap towards improved public participation, as they include citizens and giving them increased power. The third step, *informing*, is the first crucial step towards public participation. Informing citizens about urban plans and ideas, allowing them to build their own thoughts and express their ideas. However, the information step often tends to be implemented at a late stage in the planning process, where the possibilities for citizens to influence the land-use plans are limited. This, for instance, is due to the plans already being in an advanced stage (Arnstein, in LeGates and Stout, 2016). Step four in the ladder, *consultation*, is a step closely related to the subject of

Public participation and PPGIS. Here, surveys or meetings are two popular consultation methods (Arnstein, in LeGates and Stout, 2016). It is also required by Swedish law that such methods, well fitted into this step, are employed during public participations regarding land-use plans (Boverket, 2017). However, a risk is that participation becomes ineffective if methods from the fourth step of the ladder are not combined with other participation methods. A major concern with this step is the fact that these processes do not give the citizens any assurance that their opinions will be considered. Instead, a risk of citizens *participating in participation,* is rather overwhelming as their opinions becomes just tokens of participation and have no influence on the decisions (Arnstein, in LeGates and Stout, 2016).

Furthermore, there are additional four steps of Arnsteins participation ladder. However, since the methods are not closely related to the subject of PPGIS or the traditional participation methods used in Swedish land-use planning, they will not be a large part of this chapter. Step five, *placation*, is a step regarding a method where representatives from the population, often poor or differently marginalized, are included into planning boards, where decisions are made. Three steps of what can be described as pure *citizen power* follow. *Partnership* is where planning boards comprise of citizens, other stakeholders and the powerholders and where all, in theory, get equal power regarding decision-making. *Delegated power* and *Citizen control* are the following two steps, where citizens demand partial or full control over parts of the city regarding what is planned and built there (Arnstein, in LeGates and Stout, 2016).

The ladder of participation, by Arnstein (Arnstein, in LeGates and Stout, 2016), shows that a few of steps relevant for this thesis. Although the non-participation methods (steps one and two) are highly undesirable, these are not likely to be implemented (e.g. due to current Swedish law) and it is also not the purpose of the thesis to study this. I did not identify steps five to eight as steps where PPGIS plays a decisive role. Therefore, they are also not relevant for the thesis. Instead, steps three and four are of great interest as they clearly relate to the present situation in Swedish land-use planning, as well as hold possible components of PPGIS. The methods of participation will be discussed later in the thesis, with these steps as a background for the discussion.

2.3.1 Top-down and bottom-up approaches

As seen above, Arnstein's (Arnstein, in LeGates and Stout, 2016) ladder of participation defines a framework starting with a strong organizational structure, where powerholders are in control of the information, decision making and consultation later changing to an organization structure where the power of information and decision making lies in the hands of the public or other stakeholders. Organizational structures such as described by Arnstein can be described as top-down and bottom-up structures.

A top-down structure is an approach where the authorities (in the case of this thesis it is the municipality) hold the power and in the most extreme cases, participation of citizens is limited to authorities informing the citizens on the plans. Serra Llobet et.al. (2016) described the top-down structure of water planning in Spain, where the general approach is an acceptance of regional and state authority over water planning. Such approach can also be applied to this case, as a top-down control of municipal planning is an acceptance of the municipal government authority as a single powerholder. Furthermore, Serra-Llobet et.al. (2016) describe top-down control as subject to goals and time frames, common to all bodies. Participation in a top-down governance structure can provide additional information, however, the ownership process needs democratic and well structured (Serra-Llobet, et.al., 2016). The top-down mechanism can benefit from its trickle-down effect, as solutions easier will affect all decision-making processes (Abrams et.al. 2009).

A bottom-up structure is a structure where the local control of each body is strong, and where the government is present, however does not hold as much power as in the top-down structure. The governmental organization is characterized by a common framework. However, goals and timelines can be defined by the local governing bodies. In theory, on the top of Arnstein's ladder, each governing body can be one individual citizen. A bottom-up structure is more likely to generate new knowledge regarding the processes, due to the high ownership of the proposed projects (Serra-Llobet et.al., 2016). An issue with a bottom-up perspective is that participation and acceptance of the general goals and timelines from local actors, such as individual citizens or small local associations, can vary and effects of solution on a local level can be lost on a higher level, as no natural trickle-down effect is present. However, access to funding projects by applying common goals and timelines is often proven to be an effective strategy (Serra-Llobet et.al., 2016).

The challenge of choosing the correct structure and approach is not to choose one certain approach and use it exclusively. Instead, the challenge should be to bring the top-down structure to a point where it meets the bottom-up strategy. As both approaches have their advantages, it is vital to the democratic values and information volumes to combine both. The government can rarely cover all the bases, regarding both economical terms and knowledge terms, hence they need some bottom-up. However, to be efficient, it is necessary to have a powerholder capable to apply common goals and timelines, therefore certain top-down is still needed (Abrams et.al., 2009). Translated into the ladder of participation, the most advantageous steps would be steps 4 or 5, as they combine both top-down and bottom-up approaches.

2.4 A framework for evaluating participation methods

An evaluation of public participation methods is provided by Rowe and Frewer (2000), in their article *Public participation methods: A Framework for Evaluation*. This evaluation will serve as a base for the evaluation of the methods in the thesis. Table 1 shows characteristics of public meeting and public opinion surveys, which is the first step of evaluation of the two methods.

Table 1 shows characteristics of traditional methods and PPGIS methods, (Rowe and Frewer, 2000, Public opinion surveys description is altered by author to fit PPGIS description).

	Nature of Participants	Time scale/duration	Characteristics/ Mechanism
Public meetings, hearings	Interested citizens, limited by size to venue. True participants are experts and politicians making presentations	Entire process may last many weeks/months, even years. Usually held during week-days/working hours	Entails presentations by agencies regarding plans in open forum. The public may voice opinions, but has no direct impact on recommendations
Public opinion surveys (e.g. PPGIS)	Large sample (e.g. 100s or 1,000s), usually representative of the population segment of interest	Process is often open during several weeks/months. Answering usually lasts several minutes, through e.g. internet	Held by an internet based PPGIS application. May involve variety of questions. Used primarily for information gathering

As seen in Table 1, there are certain differences between meetings and PPGIS surveys, in terms of their characteristics. However, to evaluate these, a gauge for what an effective participation method is, is required. Rowe and Frewer (2000) present a set of criteria for evaluating and comparing the methods. These are in chapter 3 below and will serve to evaluate the efficiency of the methods, based on the representativeness of respondent, independence of participants, possibility of early involvement, influence of final decisions, structured decision-making, transparency and cost-effectiveness (Rowe and Frewer, 2000).

3. Methodology

The methodology chapter consists of a description of data and methodology for the results. In the first part, the data gathered and used for the result is described and in the second part, the methodology for the results is presented.

Figure 3 presents a flowchart of the study. From left to right is the GIS part, where data from PPGIS consultations provide result for GIS-analyses using Hotspot-analysis and response rate analysis. From right to left is the data regarding public meetings which, together with PPGIS data and own results from the process of leaving comments in PPGIS results in an evaluation of participation methods.

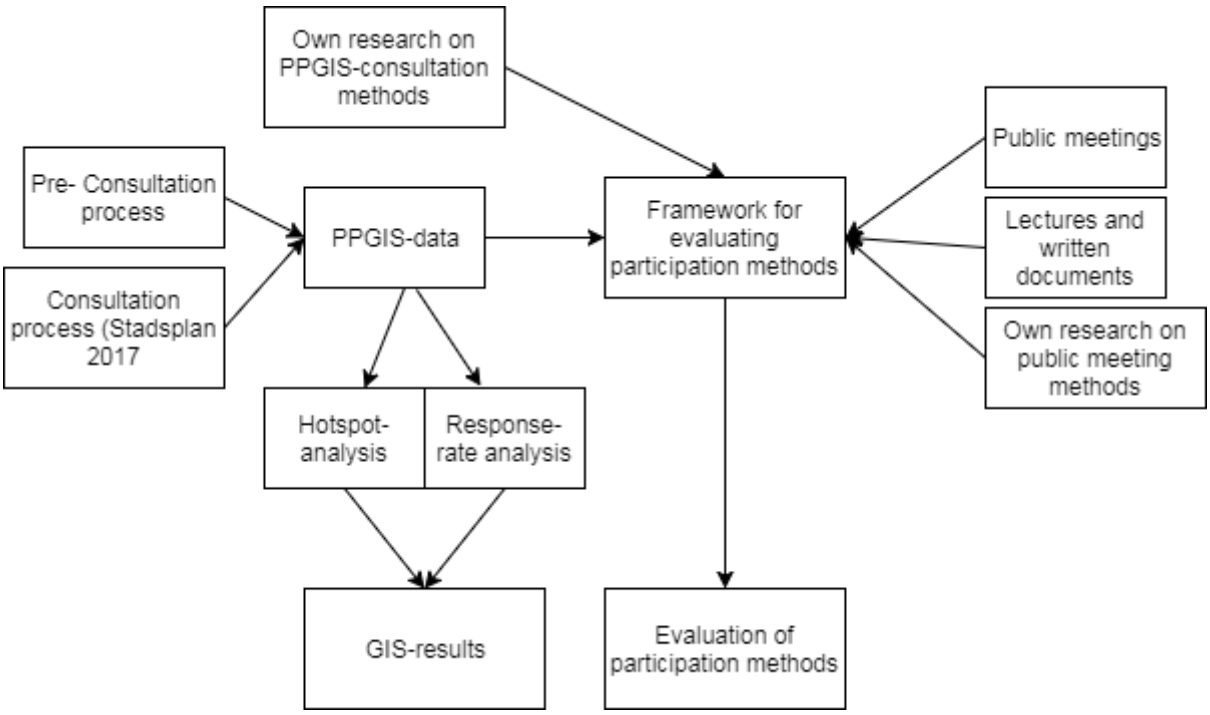

Figure 3 - Flowchart of the study

3.1 Data

3.1.1 Data regarding framework for evaluating participation methods

The data on which the evaluation framework is based is data gathered from attending meetings, conducting test on participants and on the tools. Results regarding the acceptance are taken directly from the GIS datasets, as well as own attending of meetings. The sample size for the GIS data where the entire set (in total 1400 entries). Sample size for the public meetings where 1 attended meeting, as well as several documents with information regarding

participant's numbers on meetings conducted during ÖP 2010 consultation period. All other criteria, with the exception for structured decision-making, are based on data from own studies of the tools and processes, where I conducted tests and research on how and where to find results from consultations, how long the processing of data takes (by studying and asking officials) and what possibilities the structures of PPGIS and public meetings gives, by conducting my own tests on the tools. Structured decision-making data were gathered using studied persons (a focus group of four) where all were given the similar task (leave a comment on a simple PPGIS), this was later compared with their estimated time to attend a public meeting.

3.1.2 PPGIS data

The PPGIS data originates from two different data collection sessions. In both cases, the results were point-data layers. The first session was conducted before the formal consultation time for Stadsplan 2017. These data were collected during the spring of 2016 as a non-formal process of what citizens thought of Helsingborg (based on *Tyck om Helsingborg eng. Thoughts about Helsingborg*, which also was the name of the project). The Swedish National Board of Housing, Planning and Building contain methodologies based on, amongst other, the Planning and Building Act on how consultations should be conducted. This includes the length of the collection process, who should be contacted in the matter and finally a regulation that all opinions collected (both formal and informal) should be revised and accounted for (Boverket – samråd, 2017). In absolute terms, sample sizes differ a substantially. The sample size of the pre-consultations set were 1250 entries and sample size of the consultation dataset were 158 entries. As these are often treated as one, combined dataset, the results of the GIS-analyses are heavily dependent on the pre-consultations dataset.

The resulting data were collected using similar, ArcGIS Online-based, tools where citizens could map a certain place by leaving a point and answer questions regarding if the certain place got qualities or if it can be improved, along with a comment. Everyone interested (not only from Helsingborg) was able to leave comments in the tools.

The quality of the data is mostly high, as most of the comments were left by people interested/skilled in computers, or with the help of officials who helped citizens to leave

comments on certain occasions during the consultation period. However, it is important to stress that parts of this data can be results of failed attempts.

Apart from leaving comments regarding the land use, respondents were also asked a non-obligatory question regarding their age (with the options “youth”, “adult” or “older”) and gender (with the option “male”, “female” or “other”). These data were stored in a geodatabase, to which I was granted access for scientific purposes. The sample size of this dataset is 1250 unique entries (Helsingborgs stad, 2017).

The second dataset consists of data collected during the formal consultation process of Stadsplan 2017. These data, collected in the analogous way as the previous dataset using ArcGIS Online, did not include any personal information from the respondents. Instead, only questions regarding the proposed land-use plan Stadsplan 2017 were asked. Respondents mapped if a certain idea in connection to the mapped area was good or bad, along with a possibility to leave a comment. The Stadsplan 2017 survey was conducted by combining several Story Maps templates to create a tool for visualization of the proposed plans and a simple ArcGIS Online survey template. In the template, citizens had the tool to pan and zoom in on a map, and leave comments on it by clicking the map and writing (Helsingborg stad, 2017). Story Maps is an ESRI developed tool for ArcGIS Online, where maps are combined with narrative text, images or multimedia. The purpose of Story maps is to mediate as much information as possible using maps combined with the described types of media (Story Maps FAQ, 2017).

The tool for collecting the data was incorporated with the document for Stadsplan 2017, which was entirely a digital document, produced using Story Maps for ArcGIS Online. The tool allowed citizens to pan, zoom and search for addresses and properties in the city. The zooming was limited to a scale of 1:200 and the extent of the map were the city of Helsingborg. Three different layers served as background (bright greyscale road map, dark greyscale road map and orthophoto) on which the citizens could click and leave the information (Helsingborgs stad - Stadsplan 2017).

3.1.3 Background data

Almost all background data for the maps is produced and distributed by the Swedish National Land Survey Agency (Lantmäteriet). The coordinate reference system for the data is SWEREF99. However, data containing the borders of districts of Helsingborg, were collected through city of Helsingborg (Helsingborgs stads statistikdatabas; 2017). Figure 4 shows the districts of Helsingborg. The data originated from the city of Helsingborg and required some processing to fit its purpose. This may have a slight effect on the quality. However, the overall quality from both this dataset and the dataset from Swedish National Land Survey Agency are at a high level, as it comes from official sources.

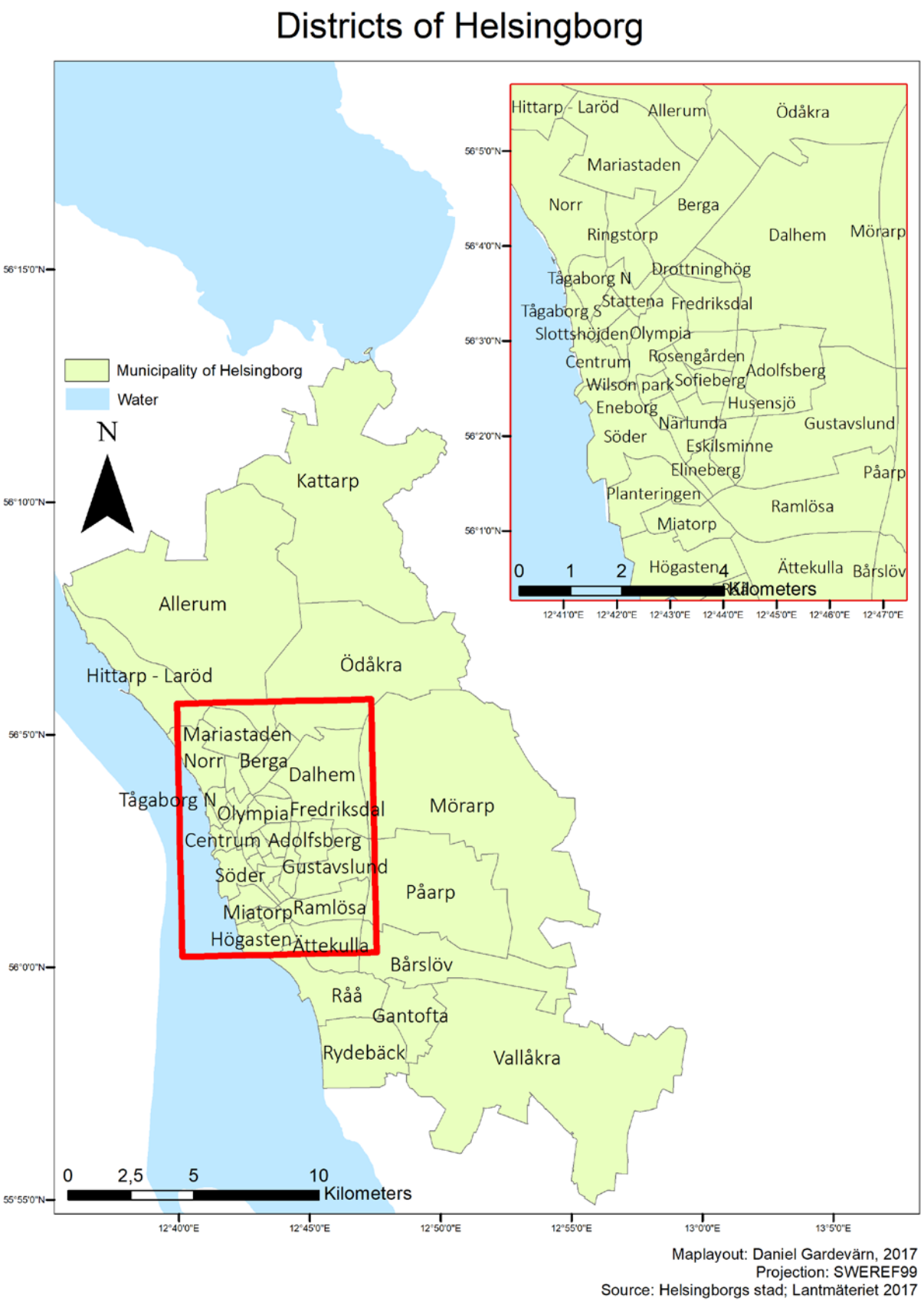

Figure 4 –The districts of Helsingborg, source: Helsingborgs stad 2017; Lantmäteriet 2017

3.1.4 Administrative data for the city of Helsingborg

Data regarding information for the population for Helsingborg, such as the average age, unemployment levels and income of the residents in all districts, were collected from Statistics Sweden (SCB, 2017). The administrative data contains income, employment levels and number of citizens on district areas of Helsingborg. The data originates from SCB and is published for the public. It is updated on a yearly basis and contains precise data regarding the studied areas, as it comes from governmental sources.

3.2 A framework for evaluating participation methods

In this thesis, I apply the framework of Rowe and Frewer (2000) to evaluate PPGIS and Public meetings as public participation methods. Certain criteria have been selected to be measured and evaluate the participation methods. Firstly, the characteristics of all the criteria used in the evaluation are presented. The evaluated material for this part is based on PPGIS consultations from Stadsplan 2017, an addition to the master plan of Helsingborg, which used PPGIS as one of its participation methods. My PPGIS analysed data is based solely on the PPGIS part of Stadsplan 2017. The methods regarding public meetings are based partly on ÖP 2010 as well as on ongoing minor consultation public meetings, such as a meeting with owners of allotment gardens. In the consultation process of ÖP 2010, mainly public meetings were used as participation method, and no PPGIS were employed.

Acceptance Criterion

The public participation must be representative of the public. A broadly representative sample must **therefore** be given possibility to express their opinions. A concern expressed frequently in the literature regarding public participation methods is that the methods need to represent a broader public, rather than a self-selected subset. In short, marginalized poorer groups or segments of population should not be disenfranchised. Another concern is planning over boundaries, as decisions within a city can have heavy implication on cities or municipalities in closest vicinity (e.g. if a decision is regarding an area close to the border of such municipality). True representativeness can only be achieved when members of all affected communities, including other municipalities or even nations, can be canvassed. However, this approach can lead to certain constraints, such as political, language, or organizational or

financial limitations (Rowe and Frewer, 2000). Large volumes of data are also desirable since it is important for a planning official to avoid hearing only from activists of the powerful elite. Instead, officials must reach out into the community (Hansen and Prosperi, 2005).

The acceptance criterion is measured based on the volumes and diversity of the response i.e. more data is better. Data from more groups in the society is also of higher value.

Criterion of independence

The criterion of independence is simply a criterion that everyone should leave their opinion or comments independently, in an unbiased way. Likewise, officials should also be independent from any sponsoring body (Rowe and Frewer, 2000). This is measured by the process structure. What possibilities, to answer independently (i.e. alone, not affected by anyone else), are given? The more possibilities to answer "alone", the better.

Criterion of early involvement

The criterion of early involvement refers to the desire that the public should be involved as early as possible in the decision-making process. The possibility for the planners to involve citizens into the planning processes is what is being measured here. Possibilities to involve the citizens early favours the results of early involvement criterion.

It may not be sensible to involve the public in parts requiring technical skills, such as scientific assessment of risk. Subsequently, including the public too early might also bring disadvantages. Such disadvantages can be that too many opinions of all standpoints (e.g. religious, political or social) early in the process might confuse and hinder the decision-making process, by only producing defensive arguments. However, at a stage where judgement becomes important, and a psychological and sociological understanding of risk is necessary, the public should be consulted (Rowe and Frewer, 2000).

Criterion of transparency

A transparent process is generally assumed to be a certainty. This is also highly regulated by law (Boverket, 2017). The wider public needs to see what is being done in the land-use planning. If any information during the decision-making process needs to be withheld out of security or sensitivity reasons, the nature of this decision should be clearly stated, rather than risking discovery of such secrecy, with subsequent adverse reactions (Rowe and Frewer,

2000). A gauge for transparency is the possibilities for citizens to see as much of possible of the process. This involves what documents are published and presented and how the citizens can be assured their participation affects the planning.

Criterion of influence

The influence of the participation methods is vital to be credited as democratic. However, not all participation processes ensure the participants that their opinions are influencing the decisions.

Some measures can be done to strengthen the influence. For instance, highlighting areas where the public suggestions did affect the outcome is a way to strengthen the credibility. However, it is important not to give away too much power in favour of credibility based on decisions made with emotions or prejudice (Rowe and Frewer, 2000). What is measured here is the actual effects of the consultation results, and of the two methods, have on the decision-making process. The possibilities to reassure the citizens that their opinions are used in the process are the vital gauge for influence.

Criteria of structured decision-making

The mechanism for the participation should provide appropriate tools and mechanism for the participation process to be credible. The decision-making process should be clearly stated and it should also be clear which mechanism or tool refers to which processes. It is important that underlying mechanisms for decision-making are understood by the public and possibilities to use them (e.g. attend meetings or use GIS-tools) are given (Rowe and Frewer, 2000). A gauge for structured decision making is that the possibilities to leave comments at any time and any place. The smaller time constraints for leaving comments, the better. Finally, the more flexibility regarding the physical place where comments are left, the better.

Criterion of cost-effectiveness

For sponsors of the participation process, it is significant that the process is generates results at a fair cost and pace. Value for money is a motivating factor and important for the organization of a participation process. An example of this is when a major public hearing might not be appropriate for a small decision-making process, as it will have rather small implications. Taking account of potential costs of a participation method, prior to its

employment, is clearly a sensible strategy, both in monetary terms, but also terms of time (Rowe and Frewer, 2000). How much does the process of gathering data from the public cost, in comparison to the volumes created, is the gauge for cost-effectiveness? The lower the cost, in relation to the data volumes, the better.

3.3 Spatial-Analyses

3.3.1. Response rates and hot spot mapping

The GIS-component of the result chapter consists of several different maps based on the GIS-analyses. The first GIS-analysis is an analysis of the response rates of both datasets combined. The results are based on the number of entries in each of the districts of Helsingborg, divided by the number of population in each area, and finally multiplied with 1000.

Furthermore, a hotspot analysis is presented. A hotspot-map shows statistically significant clustering of attributes. This analysis is based on positive and negative comments from both datasets combined. The negative comments (i.e. comments regarding city improvement "I have a better idea" in the Stadsplan 2017 dataset and "This area/place needs improvement" in the pre-consultations dataset) were assigned value of 0. All the positive comments were assigned value of 1. Subsequently, this dataset was subjected to an optimized hotspot analysis using Getis-Ord G_i* statistic test. The equation which Getis-Ord G_i* is based on is presented:

The Getis-Ord local statistic is given as

$$G_i^* = \frac{\sum_{j=1}^{n} w_{i,j} x_j - \bar{X} \sum_{j=1}^{n} w_{i,j}}{S\sqrt{\frac{\left[n \sum_{j=1}^{n} w_{i,j}^2 - \left(\sum_{j=1}^{n} w_{i,j}\right)^2\right]}{n-1}}}$$

Where x_j is the attribute value for feature *j*, $w_{i,j}$ is the spatial weight between feature *i* and *j*, *n* is equal to the total number of features and:

$$\overline{X} = \frac{\sum_{j=1}^{n} x_j}{n}$$

$$S = \frac{\sum_{j=1}^{n} x_i^2}{n} - \left(\overline{X}\right)^2$$

The G_i^* statistics is a z-score so no further calculations are required.

The Getis-Ord G_i* statistics create a map of statistically significant hotspots and cold spots, based on the inputs of z-scores and p-values. The search radius for the Getis-Ord G_i* were 500 meters. The z-score represent the standard deviation of the positive and negative values (i.e. value 1 for positive, and 0 for negative) within the defined area. The p-value is the probability that you have falsely rejected the null hypothesis, which in Figure 5 is found on the same axis as the z-score. The aggregation method was based on overlay of a fishnet polygon where a number of incidents within the fishnet polygon along with their value were analysed to provide the cold and hotspots.

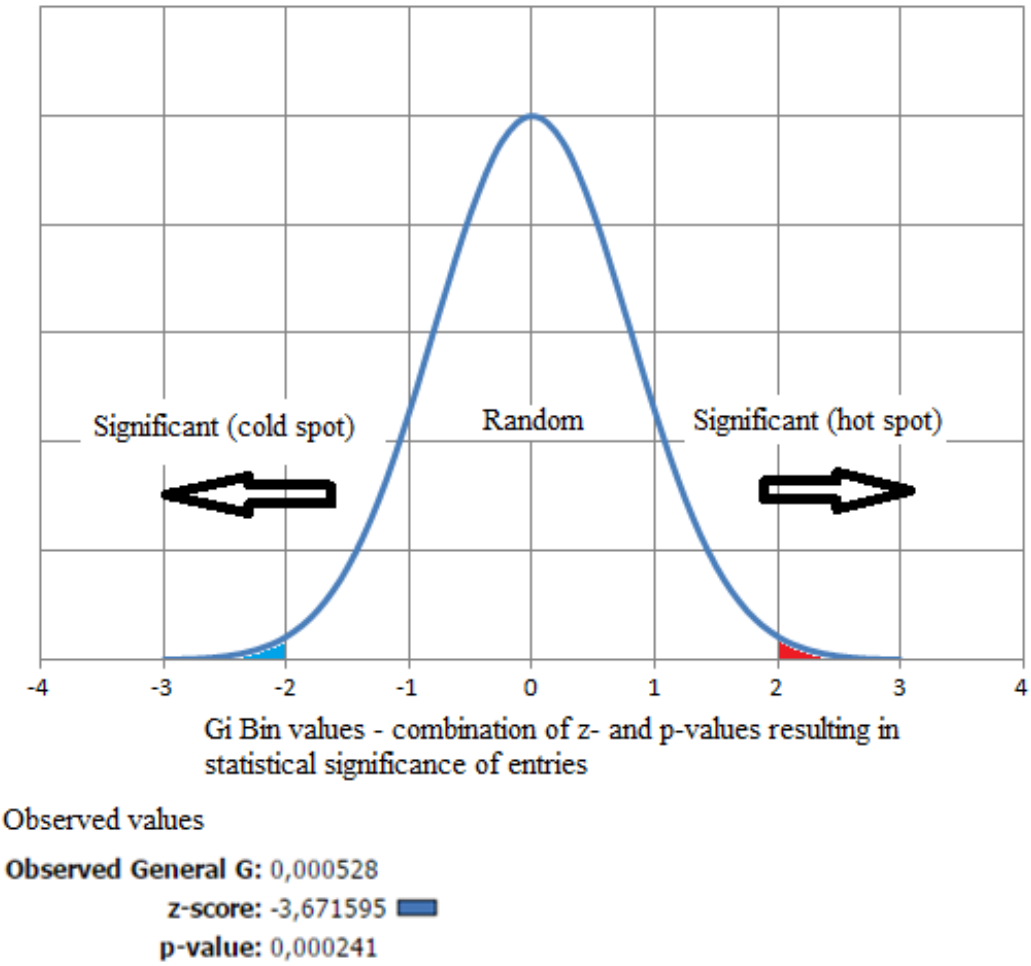

Figure 5 – standard deviation of curve and the z- and p-values, which the Getis-ord G_i* result is based on, source: own; Observed values generated using ArcMap tools

The confidence level threshold is 95% for the hotspots. All points with confidence exceeding 95 % are significant enough to be considered as hotspots or cold spots. The percentages are based on the G_i Bin, which is a calculation or p-values and z-scores. To achieve a clear score, all G_i bin scores of high significance (G_i Bin 2 or higher) is assumed, in the map, as one class. All results of high negative significance (G_i Bin -2 or lower) are assumed as one class. Figure 5 shows that, assuming normal distribution of the points, the negative entries (which are the answer to the research question of what areas need revitalization) are not as clustered as the positive entries from my data. However, some patterns in clustering of negative entries are found and presented in the result section. The resulting map is an analysis of the statistically significant clustering of the attributes.

Finally, a map showing the districts is presented. This map aims to give a clear and mathematically grounded answer to which area is statistically significant regarding positive or negative entries. The mathematical calculation made in order to present the result is a mean of the G_i Bin score for each of the areas. Areas with means between 1 and 3 are assumed to be "positive areas" and areas with standardized mean of -3 to -1 are assumed as areas in need of revitalization. The sample size, which is the size of each area, can affect the result. However, to present an as correct picture of each area as possible, an inclusion of all points within the area is required.

4. Results

This chapter describes the result gained from my findings regarding the PPGIS participation method and public meetings method. Further on, results from GIS-analyses on the PPGIS collected data from pre-consultations and consultations in connection to Stadsplan 2017, are presented. Maps with analyses are provided and described with the purpose to be discussed further in the thesis.

4.1 A framework for evaluating participation methods

Rowe and Frewer (2000) provide an evaluation of traditional participation method (public meetings and hearings). This evaluation serves as a base for this chapter.

4.1.1 Acceptance criterion

Volumes of data

The PPGIS participation method resulted in higher volumes of data, than traditional participation methods. The pre-consultations process resulted in 1.250 entries and the consultation process resulted in approximately 160 entries. This results in an approximate total of 1.400 entries. It is of importance to note is that each entry does not have come from an individual citizen. One citizen can comment several times. Entries from ÖP 2010, which serves as an example of employment of traditional methods, resulted in 10-15 visitors in each of the 6 meetings arranged for the public. Table 2 describes the differences.

Table 2 shows estimation of entries from PPGIS consultation and Public Meetings

	PPGIS (Stadsplan 2017)	Public meetings ÖP 2010
Participant levels – non-formal (comments on meetings	Approx. unique 1.400 entries (each entry do not have to be unique for one respondent)	Combined total of 60-100 visitors at all meetings
Participant levels – formal opinions left in a form, with personal information to the citizens	Over 300 entries	4 entries

All non-formal comments classified a certain area as positive or negative and around 60-70 % of all entries included a useful comment regarding the area (comments that were not blank, not "junk" or were constructive). Apart from non-formal comments, a form available in the tool also allowed people to leave formal comments, to which an answer was required from the officials. It is hard to say, in absolute numbers, how these numbers compare to traditional methods. What is said informally, in a traditional meeting, is not always recorded.

Declared age and gender of respondents

In terms of spread amongst diverse groups of the society, PPGIS attracts a more diverse population than public meetings. The age-groups are more equally represented, than in public meetings. Table 3 shows results from the PPGIS-consultations of declared age group of the respondents.

Table 3 shows declared age-group from pre-consultations, source: Helsingborgs stad, 2017

Declared age-group distribution of respondents	Number of entries (out of the total of 1250)	Percentages
"Youth"	46	3.6%
"Adult"	936	74.8%
"Older"	108	11.5%
No entry	160	10.1%

If “Youth” is age 0-18, “Adult” is 18-65 and “Older” is 65 and up, the distribution of age participation is more even. Youth are still a rather unrepresented group. However, the elderly are not over-represented.

Public meetings often attract older generations. The representation of youth (ages 0-18) is nonexistent and the overrepresentation of elderly (ages 60 and up) is very high (Pettersson 2017, “Möte med kolonister”, 2017).

The spatial distribution shows that entries from youth are exclusively found in the city of Helsingborg, with few exceptions outside of the city core. Several areas had more than 3 entries from the group youth, with Tågaborg having 11 entries from youth. Almost no entries from youth came from the villages outside of Helsingborg. Entries from the group older are also found mainly in the city of Helsingborg, with few exceptions found in the villages such as Mörarp which have 3 entries. Entries from elderly are found in similar areas of Helsingborg as youth, with few exceptions, such as Norr which have 11 entries. Just north of Centrum are found the areas where most elderly left their comments, with over 20 entries from elderly in Tågaborg. Adults were spread rather evenly over city of Helsingborg. Interesting is that almost all entries in southern parts (such as Söder, Råå and Rydebäck) are from adults, as these areas contain over 25 entries from adults per area. Figure 6 shows the spatial distribution of the age-group declarations amongst the respondents of PPGIS-consultations.

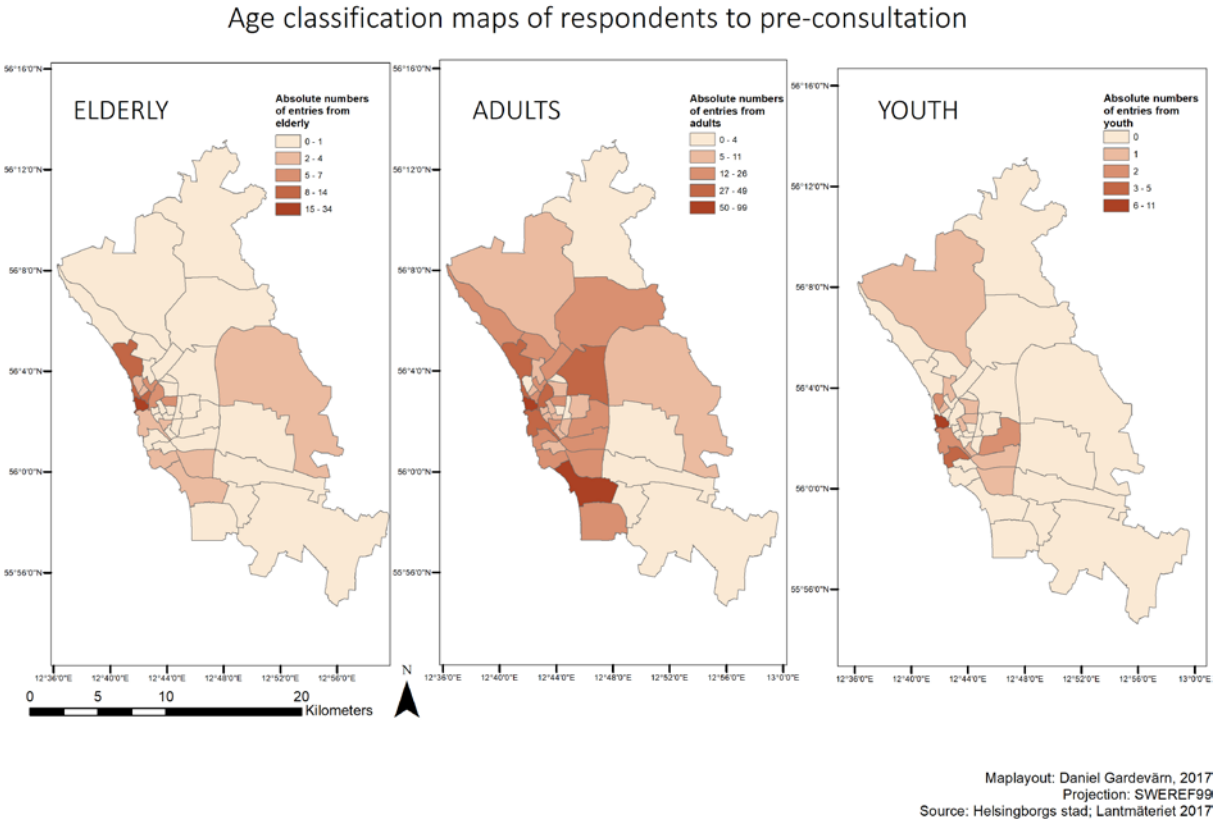

Figure 6 – Age-group distribution from the pre-consultations, source: Helsingborg stad 2017, Lantmäteriet 2017

The group elderly and youth are interested in the main core of the city. Closer to the city center means more entries from those groups. The group elderly has a bit more interest in the northern areas, as their responses are focused around those areas. The focus of the youth is located just southern of the city center.

The spread amongst genders is also even in PPGIS consultations. Males account for 46 % of the respondents, while declared females account for roughly 40 %. However, almost 15 % decided not to declare their gender, which can have a considerable effect on the outcome.

Table 4 shows declared gender from pre-consultations, source: Helsingborgs stad, 2017

Declared gender	Number of entries (out of the total of 1250)	Percentages	Public meetings rough estimation from meetings
Male	576	46%	65 %
Female	496	39.6%	35 %
Other	2	> 0.01%	-
No entry	176	14.4%	-

The spatial distribution of gender shows that entries from those who declared themselves as males are generally found closer to the city center of Helsingborg. Areas such as Råå, Tågaborg but also Dalhem, a bit away from the city center, are all areas that experience entries over 20 entries per area, from males. Those who declared themselves as females are generally more spread over the entire municipality. In similarity to men, most entries from females are found in the city center. However, some areas outside of the city, such as Ödåkra or Allerum, have over 5 entries from females. Figure 7 shows the spatial distribution of declared gender of the participants.

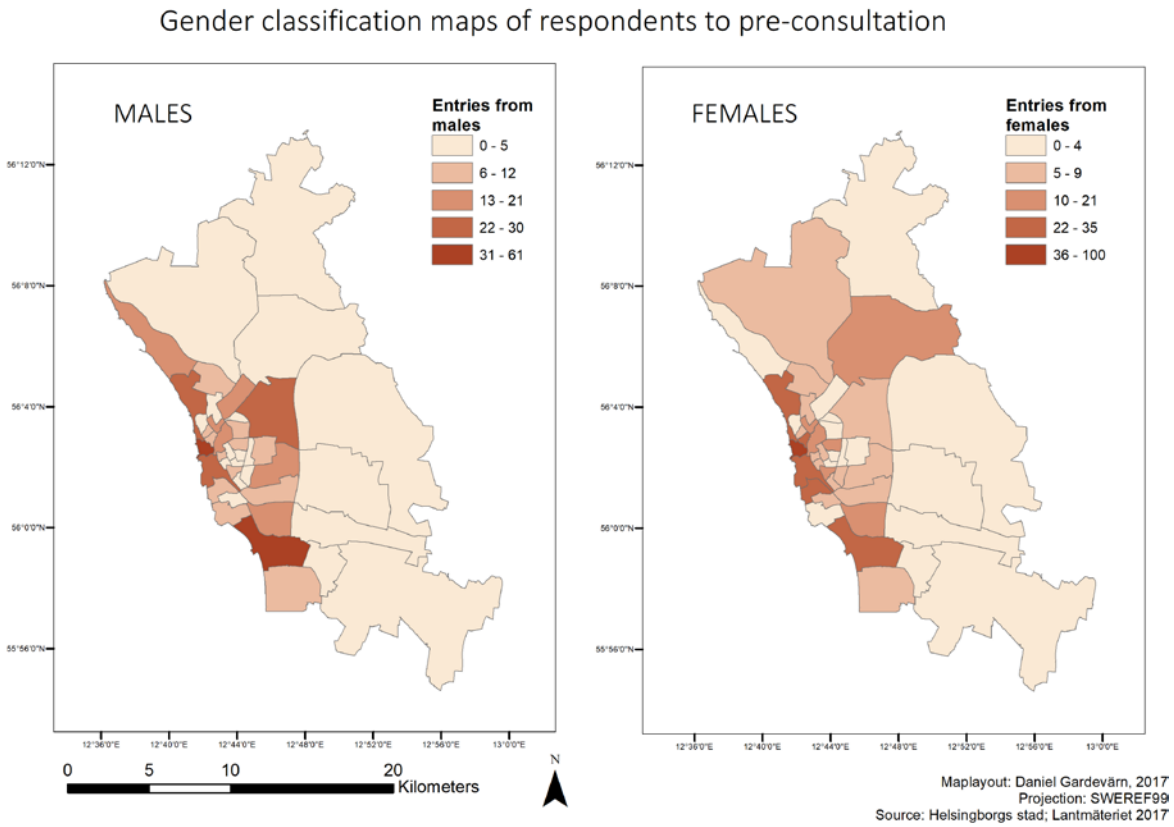

Figure 7 – Declared gender of participants in pre-consultations, source: Helsingborg stad 2017, Lantmäteriet, 2017

Youth, which can be interpreted as children, are still coming across as underrepresented. However, in absolute numbers, a total of 44 entries came from youth. The differences between genders are also not as obvious. Those who declare themselves as older women are more common than those who declares themselves as older men. Table 5 summarizes the age and gender part of representativeness for the Stadsplan 2017 consultations.

Table 5 shows summary of declared age and gender of the PPGIS respondents, source: Helsingborgs stad, 2017; own findings

Declared age-group and gender of the respondents	Number of entries (out of the total of 1250)	Percentages
Youth - women	20	1.6%
Youth - men	24	1.9%
Adult - women	408	32.6%
Adult - men	506	40.4%
Older - women	64	5.1%
Older - men	42	3.3%
Other or no entry	186	15.1%

Public meetings generally attract more males than females. My attended meetings show that roughly 60-75 % of the attendants are males ("Möte med kolonister", 2017).

4.1.2 Criterion of independence

The results show that PPGIS allows a more independent commenting for respondents, than public meetings, as they do allow respondents to leave comments alone, or in company of just one person. My results showed in most cases, only the respondents were needed to leave comments, as everything needed to do so was provided through the internet. An additional individual was needed only on certain occasions to guide the participant through the tool. A survey questionnaire is often designed to be answered individually. PPGIS-surveys, published on the internet, can be answered in isolation, with minimal influence from others, whereas public meetings are held in groups (both smaller and larger) and the respondents can hear each other's answers ("Möte med kolonister" 2017).

This indicates that PPGIS does not require as many individuals as public meetings. Table 6, shows the typical number of other individuals, i.e. others who usually are present when leaving comments. PPGIS can be done in isolation, however, if help is needed to leave comments, friends or officials are examples of other possible of being present when leaving comments. Meeting with owners of allotment gardens attracted 60 participants.

Table 6 shows the typical number of other individuals present when citizens leave their comments, source: own results

	PPGIS	Public meeting
Number of present individuals (other members of public and officials)	0-1	Approximately 60

4.1.3 Criterion of early involvement

I was not able to gather enough reliable data to present my own results regarding early involvement. Instead, findings from other studies serves to close this gap in the results. The results show that PPGIS gives more possibilities to involve citizens early, than public meetings. This is due to the fact that PPGIS-tools provide the possibility to reuse technical structures (such as using the same templates or even questions) and hold several consultations at the same time (as information comes simultaneously and gets automatically stored in databases) (Kahila-Tani, et.al. 2015). Public meetings however, often require a proposed plan to discuss or comment, as the process is then easier to start and attract people to.

4.1.4 Criterion of transparency

In this criterion, results regarding public meetings are gathered from written documents regarding ÖP 2010, as its consultation period were held in the year 2009. PPGIS results are my own findings, based on research of the PPGIS tool for Stadsplan 2017.

The results show that PPGIS is a more transparent participation method, than public meetings. The reason to this is that PPGIS have the possibility to store all comments and publish them for the public (connected to criteria of influence). Also, PPGIS can give the citizens possibility to see what other citizens have said, by just looking through the tool, if all data were available. This is not always the case with traditional meetings, as transcriptions are not always published, if even made.

Table 7 presents findings of published comments. In terms of PPGIS, all published comments were available to find, since PPGIS-tools stored all material and remained open even after the consultations. Official documents contained just a rough estimation of 50 %.

Table 7 shows the percentages of formal and informal comments from both methods, source: own results, ÖP 2010

Percentages of published comments	PPGIS	Public meetings
Formal opinions	0 %	0%
Informal	100 %	50 % (most can be requested by citizens)

4.1.5 Criterion of influence

Similar to the criterion of transparency, the results for criterion of influence regarding public meetings are based on documents from ÖP 2010, regarding both answers to formal and non-formal opinions. Further, results regarding answers for formal opinions for Stadsplan 2017 are based on documents published by City of Helsingborg. This is because I, as a researcher, was not granted access to the formal opinions, due to secrecy. Results regarding answers to non-formal opinions for PPGIS are my own findings.

The results show that PPGIS and public meetings are very similar in the criterion of influence. All opinions left in PPGIS can be (but do not need to be) published, while public meetings material need additional processing to be published. This can ensure the citizen that the officials have received their opinion.

Table 8 describes results from published official documents regarding consultations processes of ÖP 2010 and Stadsplan 2017, along with the current Planning and Building Act, source: own results, Stadsplan 2017, ÖP 2010

Percentage of published answers	PPGIS	Public meetings
Formal	100 %	100 %
Non-formal	0 %	0 %
Percentage of non-formal, published, comments	100 %	50 % (rough estimation as published material is a summary of what has been said at meetings)
Percentage of officials guaranteeing the public that their opinion will affect the plan	0 %	0 %

4.1.6 Criteria of structured decision-making

The results for the criteria of structured decision-making regarding the frequency and length of public meetings are gathered from documents regarding ÖP 2010. This is because the consultation period, to which those refer, was held in 2009. Data regarding PPGIS-tools are my own findings.

The results show that PPGIS give more flexible opportunities as a participation method than public meetings. If PPGIS is using an internet based solution, basically everyone with an internet connection can access it anywhere. PPGIS-tools are open 24 hours a day, seven days a week, for the whole consultation period (some restriction such as downtime may occur). Public meetings, on the other hand, are bound to a certain time and place (e.g. time and place of the meeting) (ÖP 2010).

Table 9 describes the time windows for leaving a comment, based on own studies and ÖP 2010.

	PPGIS-tools	Public Meetings
Consultation to leave a non-formal comment	24 hours a day, e.g. for a period of 30 days	6 meetings 3-4 hour each, during a consultation period of 30 days
Total	720 hours	24 hours

PPGIS is a method less time-consuming method than public meetings. A meeting requires the citizens to attend at a certain time and certain place, and speak once given the opportunity. Time consumption for a PPGIS can vary based on the users' familiarity with the tools.

Table 10 shows the results of time consumption test for both participation methods

Users' familiarity with computers	PPGIS	Public meetings (estimation based on own experience)
High computer familiarity	5-10 minutes	4-5 hours
Average computer familiarity (uses e.g. Microsoft Office, do not use GIS)	15 minutes	4-5 hours
Low computer familiarity	20 minutes	4-5 hours
Low computer familiarity and no knowledge of used language (with translation help from author)	25 minutes	4-5 hours (not always able to even attend meetings due to the need of translator)

As Table 10 above show, despite low computer familiarity, the time of leaving a comment in PPGIS never exceeded 30 minutes, and was often no more than 20 minutes. Public meetings required several hours regardless of computer familiarity, as travelling time and meeting length is roughly similar.

4.1.7 Criterion of cost-effectiveness

It was not possible to extract my own results regarding the resources needed for preparation and post-processing of material gathered from the two studied participation methods. This is due to the fact that I did not conduct any own PPGIS or public meeting consultations. Instead, data from lectures given by officials serves as results for resources needed for both projects. However, the volumes of data and a part of the post-processing possibilities (which are described after Table 11) are results of own data.

It is hard to determine the absolute costs in terms of money and time for both methods. It is assumed that the cost is rather similar for both methods. However, the volumes of data which can be gathered from the PPGIS are substantially higher than from public meetings, which results in a better cost-effectiveness (Hellman, 2016).

Table 11 shows the cost in resources for preparation in a team of planners (size of the team depends on the size of the plan or municipality). For comparison, the resulting data volumes from both processes are presented.

	PPGIS	Public meetings
Resources – preparation time	2-4 weeks	1-3 weeks
Post processing	1-2 weeks	2-3 weeks
Volumes	Approx. 1.400 entries	Approx. 60-100 unique visitors

Furthermore, my results show that the PPGIS gives more effective possibilities during the post-processing stage. This is due to the fact that PPGIS data is digitized (i.e. it is possible to preform searches and make analyses). This creates possibilities to quickly sort and analyse data. Figure 8 show effects search that was done only on a selection of entries with the Swedish equivalence to words such as “housing”, “houses” or “living” from the PPGIS-gathered data.

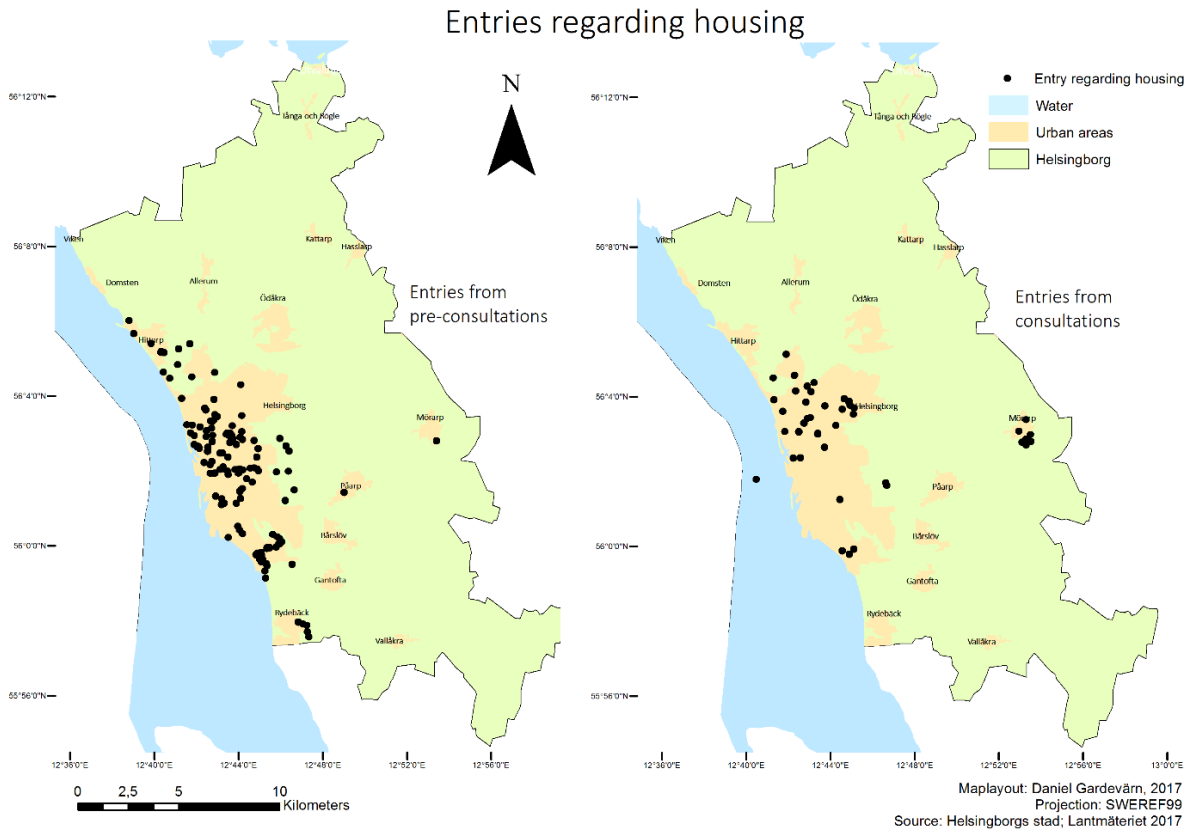

Figure 8 – Entries regarding housing from both pre-consultation and consultations, source: Helsingborgs stad, 2017; Lantmäteriet 2017

The results show that data gathered from PPGIS is easily handled, giving planners new possibilities to analyse data, compared to public meetings. Figure 8 is an example of a result of such search. All comments from public meetings may, or may not be searchable, making such filtering hard or impossible. Therefore, it is not guaranteed that officials can quickly extract the desired parts from the public meetings material. From the results, entries regarding housing are rather evenly spread over all of districts of the city of Helsingborg. All areas within Helsingborg experiences at least 4 entries regarding housing, some areas reach over 15 entries regarding housing. The villages did not attract any high numbers of respondents regarding housing with the exception of Mörarp, with entries, 9 entries. Also, Påarp got an entry regarding housing. Chapter 4.2 GIS-Analyses it further an example of what analytical possibilities GIS-data have.

4.2 GIS-Analyses

This part of the chapter presents the results from the GIS-analyses performed on the collected data. These analyses are a response rate analysis and hotspot analysis of positive and negative entries to find where clusters of these can be found in the city. The GIS-data collection process is described in the data chapter and the methodology is described in the methodology chapter for all the analyses preformed in this chapter.

4.2.1 Response rate analysis

The results of the response rate analysis show that respondents were generally negative regarding the city. The distributions between positive and negative comments are slightly uneven, where the consultation dataset received a higher relative number of negative entries compared to the pre-consultation dataset. Positive entries accounted only for 32 % of the total of 1250 entries in pre-consultation and for 10 % (of the total 158 entries) in the consultation dataset. Table 12 presents an overview of the data used for this section.

Table 12 shows an overview of responses from the two datasets

	Pre-consultation dataset	Consultation dataset
Positive entries (Good place; idea)	391 (32 %)	17 (10 %)
Negative entries (Place needs improvement; I have a better idea)	859 (68 %)	141 (90 %)

Further on, the response analysis resulted in denser response rates close to the city centre and in the south of the city core. Several areas in the eastern parts of Helsingborg, along with villages outside the city are experiencing low response rates. These areas do not exceed 10 responses per 1000 inhabitants. Figure 9 shows total number of responses per 1000 inhabitants, in each of the areas.

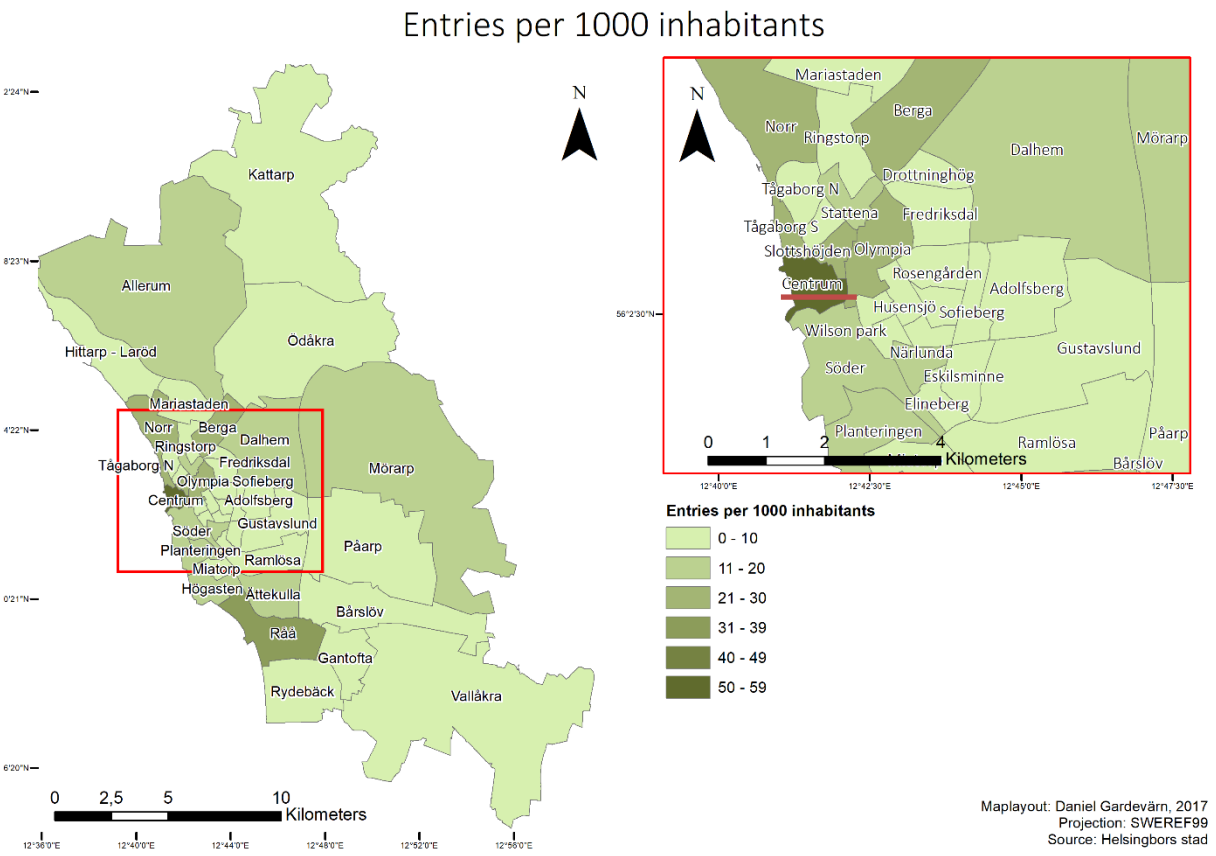

Figure 9 – Response rate map of all entries from both datasets combined, per 1000 citizens, source: Helsingborg stad, Lantmäteriet 2017

As mentioned, Centrum (underlined in figure 9), which is the most central area in Helsingborg, has the highest response rate, scoring over 50 responses per 1000 inhabitants. Råå, an area in the south of Helsingborg, experience response rate over 30 responses per 1000 inhabitants. Several areas within the city of Helsingborg experienced response rates between 11 and 20 responses per 1000 citizens. Examples of those are Söder, Planteringen, Stattena, Högasten or Dalhem.

Many of the areas where response rates are higher are located close to each other, concentrated around the central area of Helsingborg or spread along the coast. Centrum is the area located closest to the city centre and along the coast. This is also where the highest response rate is found.

Several areas experience comparatively low response rates. Almost all of these areas are villages outside the city of Helsingborg. These areas are Påarp, Ödåkra, Vallåkra, Rydebäck, Gantofta, Bårslöv, Kattarp and Hittarp – Laröd, which all experience response rates below 10

responses per 1000 citizen. Allerum and Mörarp are exceptions to this as the two areas are located outside the city of Helsingborg and where the response rates rose above 10 responses per 1000 citizens.

Examples of areas within the city of Helsingborg where the response rates where below 10 responses per 1000 inhabitants are Drottninghög, Mariastaden, Ringstorp, Tågaborg N and Tågaborg S. Many of those areas are located close to each other, in the south-eastern parts of the city. There are also relatively few areas with higher response in these areas.

4.2.2 Hotspot Analysis

The results show that several areas are identified as hotspots and cold spots. As Figure 10 shows hotspots containing positive and cold spots negative entries which can be identified in the city.

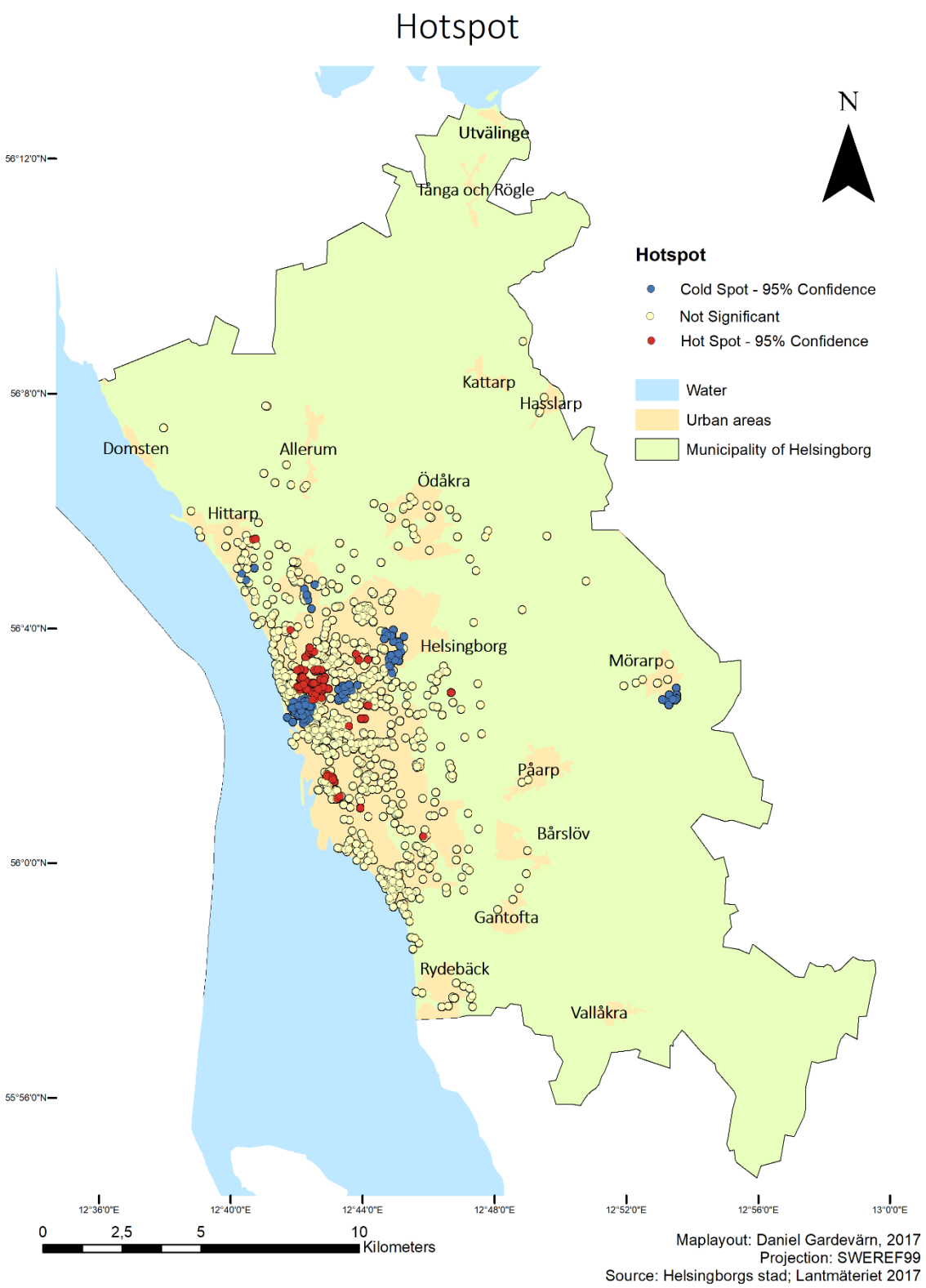

Figure 10 – Hotspot analysis of negative entries, where red colour indicates a high statistical significance of negative entries, and blue colour indicates a high statistical of positive entries, source: Helsingborgs stad, Lantmäteriet 2017

Several areas, such as the north-east part of the city of Helsingborg or Mörarp, can be identified as cold spots, meaning a high number of negative entries are found there. However, the most prominent area with numerous negative entries is found in southern parts of the city centre. Subsequently, several cold spots can be identified in e.g. Hittarp.

A hotspot can be clearly identified just north of the main core of the city, this area is the most prominent hotspot in the city, meaning that it is the area where the most positive entries are statistically significant over a specific spatial extent. This hotspot is in close vicinity to the area that is the most prominent cold spot in the city.

The districts which were identified as areas where negative entries had statistical significance are Mariastaden, Dalhem, Söder, and the village of Mörarp. All, except for Mörarp, are situated in the city core of Helsingborg. Areas where positive entries were statistically significant were Slottshöjden, Stattena, Tågaborg S, Olympia and Husensjö.

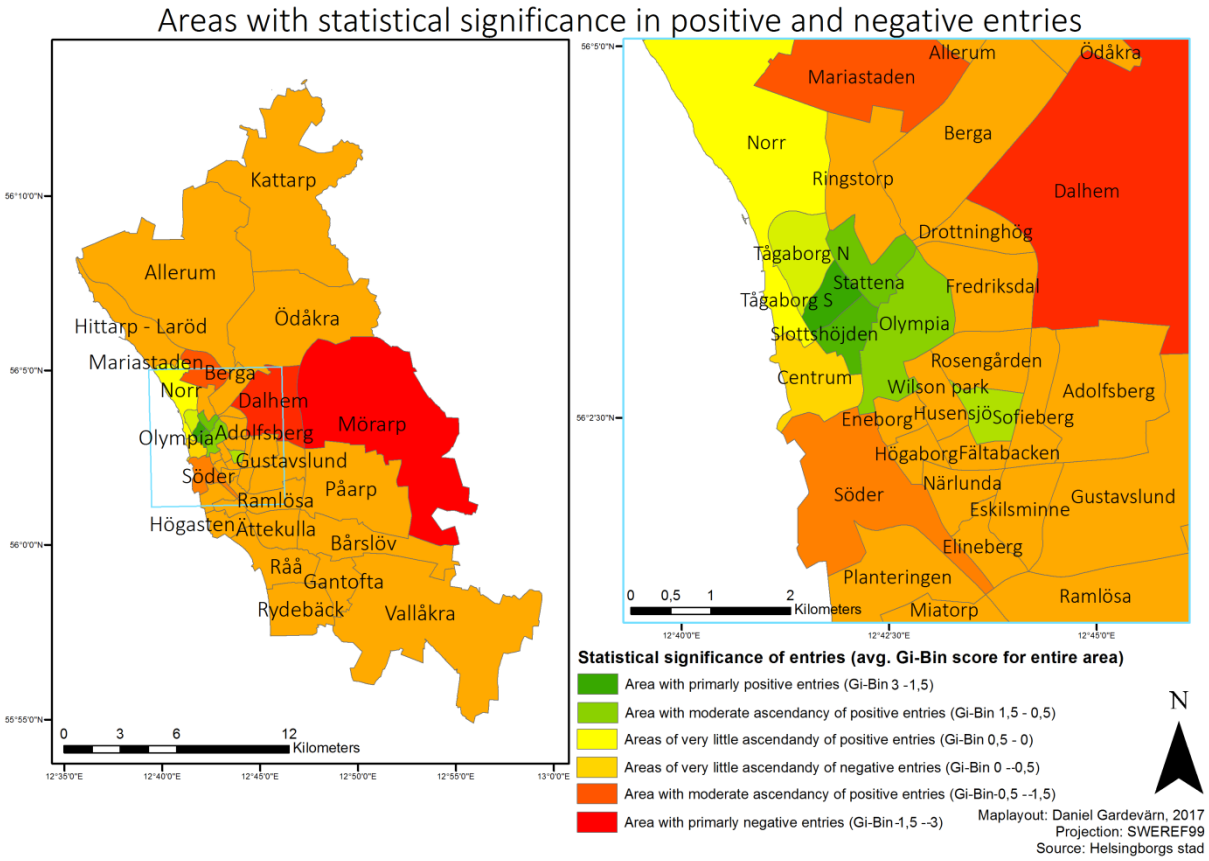

Figure 11 – Statistical significance of entries in the areas of Helsingborg. Areas with positive G_i Bin values are areas where the statistical significance for positive entries is most occurring. Areas with negative G_i Bin values are areas where the statistical significance for negative entries are most occurring (i.e. in most need of action from planners according to the citizens).

The results also show several areas where the statistical significance of positive entries was high. As shown in Figure 10, areas such as Tågaborg, Stattena, Slottshöjden, Olympia and Husensjö all have more positive entries from both datasets. These areas are primarily located north and north-east of the city core. These areas are the ones with most statistical significance for positive entries, and they are all located very close to each other. Notable is that they are also located close to Centrum, the area where the statistical significance for negative entries are the highest (along with Mörarp, outside of the city).

Generally, the distribution of hotspots and cold spots points towards people leaving relatively more positive comments along the coast rather than further in-land. With the exception for Centrum, a pattern in the distribution of areas with significance can be seen along a path going from the coast and inland. This is seen in areas as Tågaborg, Stattena and Slottshöjden. The zone of significance continues further to the east (away from the coast) to areas such as Olympia and Fredriksdal where the significance for positive entries drops. Dalhem is at the end of this zone of significance as it has a high statistical significance for negative entries. One clear exception from this pattern can be found, and that is Sofieberg. It is an area located in the south-eastern part of the city, away from the coast. Sofieberg is an isolated island of positive entries, as the areas around are slightly negative statistical significance or no prominent statistical significance.

Apart from the areas found in the city of Helsingborg, the municipality also contain Mörarp as an area with primarily negative entries. Notable is that the number of entries is, in comparison with the city of Helsingborg, low and therefore easily affected by just a few negative entries.

5. Discussion

5.1 A framework for evaluating participation methods

5.1.1 Acceptance Criterion

This section discusses the acceptance criteria of the framework used for the evaluation. Since this is an extensive section, it will be split up into two major sections: regarding volumes of data, and regarding the gender and age of the respondents. Last part of this chapter is a contextualization results with a discussion regarding the digital divide. It is a key factor, both when it comes to volumes of data and representativeness of genders and ages.

Volumes of data

My results showed that in terms of volumes of data, PPGIS is a more effective public participation tool, than public meetings. An explanation for this is the fact that PPGIS is a lot more accessible as a tool. Generally, PPGIS consultations do not have to be held at a certain place and at a certain time (which is the case in public meetings), as they only require the respondent to be connected to the internet and access to PPGIS-tool. It does not consume as much time as public meetings Another explanation as to why volumes of data are higher for PPGIS is the greater enjoyment of using it. Many users whom are familiar with important components of a PPGIS, e.g. computers, internet or maps, might find a PPGIS-survey as more enjoyable to do, in comparison to public meetings. This technology is relatively new and might therefore attract new participants as it is something they have not already done and are not tired of. This was also confirmed by Frewer and Rowe (2000) as they estimate public opinion survey representativeness as generally high, which can also be applied to PPGIS projects, while the meeting and public hearing methods are low.

To contextualize the volumes of data, a couple of observations can be made. Firstly, participation numbers in PPGIS are easier to measure, than for public meetings. Studies have shown that internet-based PPGIS project have a response rate on an average of 13 %. This regards PPGIS-projects with random house sampling. Paper-based project response rate can range between 15 % and 47 % (Brown and Kyttä, 2014). PPGIS surveys share the same challenges and roughly the same response rates with general survey responses. There are measures to increase response rates when it comes to e.g. internet-based PPGIS. However,

measures such as voucher gifts often only give a modest increase in response rates (Brown and Kyttä, 2014).

Secondly, volumes of data when it comes to public meetings are limited to a small group of respondents. The group is often limited to those who have opinions regarding the plan, often commenting negatively. Since they are mostly those who attend the meetings (Brown and Kyttä, 2014).

Thirdly, other projects, such as Helsinki Master Plan experienced similar patterns, as 3,745 residents marked 32,989 locations on the map. This means that 1% of the population of Helsinki participated. These numbers are far below the response rates Brown and Kyttä (2014) found. However, despite the relatively low PPGIS consultations response rates (in comparison to other PPGIS projects), the PPGIS consultations in Helsinki increases the number of participants reached through the meetings and workshops (Kahila-Tani, et.al., 2015). Similar numbers are found in Helsingborg. If assumed that no citizen left more than one entry, and all entries originated from people living in Helsingborg, then 1% of the population participated in the PPGIS consultations. This is an increase compared to public meetings, as the estimated participation numbers for these are barely exceeding 0.1 % of the total population of Helsingborg. These patterns were also confirmed by Kaczmarek and Wojcicki in the city of Poznan, Poland, as the distribution in PPGIS consultations tended to even out more, resulting in relatively more youth and relatively less elderly participants (Kaczmarek and Wojcicki, 2016).

Notable, is that the studied projects are seven years apart. This could have an influence on most of the results, but probably most effect on the volumes of data. These seven years may have made the citizens better informed regarding the process and more interested in planning issues in general. A greater interest in urban planning can result in higher data volumes, regardless of the participation method. Officials may have also used different, more effective, channels to inform citizens about the consultations, which may have resulted in higher participation rates for the PPGIS projects.

Age and gender of respondents

My results indicate an advantage of PPGIS over public meetings, in terms of age and gender spread in the responses. PPGIS results show that adults are the most represented group, but

youth and elderly are also represented amongst the participants. The results for public meetings indicate a higher participation of the elderly, but almost no youth. Notable is that within the PPGIS dataset, the pre-consultations declaration is optional, which can distort the results. However, these patterns are clear enough to warrant discussion. One explanation is the fact that PPGIS in often based on the internet, as it attracts youth as they generally are more familiar with the tools provided. The elderly generally prefer the traditional methods, such as public meetings, with which they are more familiar. Another explanation is, once again, the fact that PPGIS does not consume as much time, nor does it require as much effort. Therefore, families with e.g. small children might find time to leave a comment on a PPGIS tool, rather than participate in a public meeting.

The results regarding the gender of respondents show that the relation between number of males and females is more equal in PPGIS than in traditional methods. Worthy of note is that the declaration of gender in the dataset was optional. Approximately 10 % of the participants decide not to declare age, which can distort the results. The reasons behind these results are not as clear as in the volumes of data. One explanation to this is that participation meetings are often held at venues where women are not as comfortable, such as the municipalities' own facilities, since they're not used to visiting those. By employing a tool where citizens can choose their own spot to leave comments, a more comfortable setting to leave comments can be created to attract all genders. Also, settings where officials help the citizens to leave comments can be set-up in more comfortable areas, where all genders often are presents, such as shopping centres (Gålmark, 2012).

Kaczmarek and Wojcicki, and officials from the Swedish municipalities agree that males are over-represented in public meeting. However, in PPGIS consultations both from Poznan and Helsingborg, the male over-representation is not as prominent as in traditional participation. An example of more even representation from younger women in Poznan during the PPGIS consultations is the fact that representations from females up to 25 years old were twice as high from the males from the same age group (Kaczmarek and Wojcicki, 2016). The impression from officials in Helsingborgs that those who attend most meetings are older white males (Pettersson, 2017).

Digital divide

In general, the results show that PPGIS is a more representative participation method than traditional methods. However, two factors disadvantage the PPGIS in its representativeness. These factors are accessibility and usability of the tool. If those can be overcome, PPGIS would be an even more advantageous and representative participation method. The issue is often referred to as digital divide and regards to those who do not have the possibility to use internet-based, or map-based participation methods. Certain age-groups or parts of the society may not have access to the internet or a computer, or the skills to use the provided tools. Actions need to be taken to reduce the digital divide. A measure can be clear and well-structured interface making the process of leaving comments short and straightforward. Another measure is employment of wizards which guides the user through the process. Yet another measure can be better accessibility to the internet, however this is easier to arrange within a municipality, than within a country if PPGIS projects were to be applied at such scale. Finally, a possible measure can be the possibility to view other responses, which can engage the user to invest time to learn how to work with the tools (Babelon et.al., 2016). However, the most important part of the digital divide discussion is the fact that PPGIS cannot presently completely replace the traditional meetings and workshops. Instead, PPGIS should be a complementary method, and be considered as a part of the methodological "tool box" for planning officials to use (Kaczmarek and Wojcicki, 2016).

Summary

To summarize, the acceptance criterion is possibly the category where PPGIS-surveys have the greatest advantage towards public meetings. PPGIS can attract high numbers of respondents, resulting in high volumes of data. The spread between age-groups and genders is also more even in PPGIS-methods. However, it is worth noting that a digital divide is present. All groups in the society do not have the technical skills or access to the tools required for participating in e.g. internet-based PPGIS-consultations. This is a setback for the representativeness.

5.1.2 Criterion of independence

The results showed that PPGIS allows citizens to leave comments more independently, as they can leave comments alone or with just one official. This is an advantage since public

meetings require several participants (often reaching up to 15-20 participants, sometimes even more) to be considered a meeting. These patterns can be explained by the fact that PPGIS, if hosted through the internet, allows the participant to leave comments at home (or wherever they prefer) or with an official who guides the participants through the process. A public meeting needs several different participants to be effective, a meeting with just a single participant would be considered ineffective and maybe even cancelled.

The independence of participants is important since other participants and the decision makers tend to be affected by the well-informed, well-prepared and/or interested in the subject at meetings. Others may not have the time, confidence, energy or interest to speak-up, or to attend the meetings. Public opinion surveys and PPGIS projects are most often conducted at home, with no other individuals present. This can attract a new group of people (e.g. those who do not feel comfortable speaking in public) to participate (Kahila-Tani et.al. 2015).

5.1.3 Criterion of early involvement

The results show that PPGIS gives the officials better possibilities to early involve the citizens to the participation processes, compared to the public meetings. The reason behind this is that PPGIS templates and tools may be reused to a very great extent, and that the interest in leaving comments using your own device might attract more people in an early stage where no plans are proposed. In order to be held in an organized manner, public meetings require a subject to talk about. Such subject (e.g. proposed plan) may not be available at the initial stages of a process. PPGIS projects, on the other hand can be based merely on a general question (just like in the case of pre-consultations in Helsingborg) such as “What is your opinion regarding the city?” where the citizens can express their thoughts about the city, rather than a proposed plan which already required resources from officials, before any citizens were involved.

These patterns were confirmed by Frewer and Rowe (2000), as they estimate the possibilities for early involvement in public hearings as variable and for public opinion surveys as potentially high.

Early involvement in the planning process is as an important stage for the officials as for the public. Including the citizens early in process can help the officials to prepare and steer the

process to most important issues, and even avoid issues connected to miscommunications or "non-issues" (issues that what problematic but are not). An example where the citizens should be included early could be establishment of a hazardous plant. Originally, PPGIS was used to ask the public regarding the localization of this plant. However, if an early consultation process regarding the need for such plant was conducted, issues connected to lack of trust off the citizens as they were not asked might have been avoided (Steiniger et.al, 2016). Early involvement builds consensus, especially when during a phase where value judgement is formed (Kahila-Tani, et.al., 2015).

Early involvement gives the citizens a proper chance to understand and get involved in the plan, and the officials to prepare for what may become key issues with their plans and early understand the opinions and arguments used by the citizens. The potential of PPGIS projects to involve the citizens early in the process is high. However, planners need to take the first steps to encourage citizens to encourage them to use the PPGIS-tools. Efforts are needed to provide the citizens with a possibility to get involved.

5.1.4 Criterion of transparency

The results show that PPGIS give the officials improved possibilities to publish all received opinions and comment, which public meetings do not give, which gives PPGIS the upper-hand on the transparency criteria. Public meetings only accounted for a rough estimation of 50 % of the non-formal comments, as what was published were summaries of what has been said during public meetings. The technical architecture of the PPGIS-tools may explain this. Everything citizens comment on in the tools are stored in a database and subsequently published. This guarantees the citizens that the officials have received the comments. In public meetings, comments are, by default, not left written (they could be, but that is not always the case). Instead, the citizen's comments are often presented orally, and not always transcribed word-by-word. This can result in (as in the Helsingborg case) a situation where the consultation reports only accounts for summaries of what have been said. Another advantage of the PPGIS is the possibility to see the citizen's comments amongst rest of the comments left in the process. This gives the citizens the assurance that all the comments they left is in the officials' database.

An improved transparency is needed as it ensures the citizens that the officials have received their opinions, as well providing them with evidence if disagreements would occur. It can be risky to let the respondents view each other's comments, as own view can skew the results of public participation. However, participants can learn from each other inputs and respond accordingly (Babelon et.al., 2016)

To contextualize these results, physical access to documents and other material is not enough to reach complete transparency. It is just the first step. Further, steps towards to improved transparency can be access to tools to see how documents and decisions fit together. Another step can be tools for possibility to leave feedback on the documents and tools to monitor the influence the comments have on the decision process. Another important action needed for a better transparency is a feedback system on the tools provided. For planner to avoid repeating the same mistakes, all citizens should have the possibility to impact the improvement of PSSs, such as a PPGIS tool for collecting opinions (Drew, 2015).

The Helsinki master plan supported the transparency of the PPGIS project by publishing the comments from the citizens (both in original form and in a generalized and analyzed form). Furthermore, comments from the citizens were discussed via online channels and in public meetings and workshops to foster the public discussion and debate the results (Kahila-Tani et.al., 2015).

5.1.5 Criterion of influence

The results show that PPGIS has a tiny upper-hand at the public meetings. This conclusion is based purely on the fact that, all non-formal opinions are published and guarantees the citizens that his or her comments have been received by the officials. However, nowhere in the law or in the structure of the methods is it implied that the methods guarantee the citizens to any influence on the actual decision-making. What can be said is that the Swedish law requires the officials to answer all formal opinions left by citizens, regardless of the employed participation method.

5.1.6 Criteria of structured decisions-making

The results of structured decision-making show an advantage for PPGIS over public meetings, as they do not limit when or where the respondent can leave their comment during the consultation period. Firstly, comments in a PPGIS can be registered 24 hours a day, seven days a week (exceptions might occur), while a public meeting is held just a few times during a consultation period, leaving significantly fewer hours when it's possible to express opinions. Secondly, the time required for the citizens to attend the participation varies greatly. For PPGIS, based on the familiarity of computers and access to tools, the time varies between 5 and 25 minutes, whereas a public meeting requires in all cases 4-5 hours.

A time window that is always open during the consultation period and a time consumption of at most 25 minutes could attract a high number of users. Not all citizens have the possibility to spend 4-5 hours to participate. This is important for the representativeness of the tools and can explain the results from the acceptance criteria, where more citizens with, supposedly, less time to spend, participated in PPGIS compared to public meetings.

5.1.7 Criterion of cost-effectiveness

The results show that PPGIS is more cost-effective than the public meetings, due to higher volumes of data received for the same amount of resources needed for a consultation project. As it is hard to assume which of the two methods require more resources from the officials, the assumption is that the costs (in time and money) are equal for both methods. The result is then based on two factors. Firstly, the volumes of data are significantly better in PPGIS consultations, compared to public meetings. Secondly, PPGIS data received are already spatial data, leading to the possibility to undertake spatial analyses.

Despite different structures and methods, the time it takes to create maps and post-process the GIS-data is roughly the same as it takes to prepare a meeting and post-process all data gathered during the meeting. The volumes generated in the processes are already explained earlier, in the chapter regarding representativeness and structured decision-making. PPGIS generates larger volumes of data. Several factors can explain this, such as effectiveness in time consumption, accessibility or the greater enjoyment when leaving comments (since this

is a relatively new way to consult citizens, which can be more exciting than attending public meetings).

Another advantage for PPGIS in terms of cost-effectiveness is the fact that data is digitized (meaning that searching for e.g. housing was easy as all received comments are searchable) and is in GIS-data format, meaning it has a spatial connection. The GIS-data format gives the officials access to GIS-analyses. Examples of results from these have been presented in the GIS-analyses results chapters.

5.2 GIS-Analyses

The following chapter is a discussion regarding the GIS-analyses. Firstly, the results of the response rate analysis are discussed. Secondly the results from hotspot analysis is made.

5.2.1 Response rates

The response rates of the entries in the two consultations datasets showed several differences with in the areas of Helsingborg. Centrum, the most central area, is the area with most responses per 1000 inhabitants. Centrum experienced a response rate for over 50 responses per 1000 citizens, where the second area, Råå, experienced 35. As noted in the methodology part of the thesis, it is very important to keep in mind that the entries are not always from locals. People from all over Helsingborg, and even from other municipalities, have been able to leave comments in the processes. This can be a possible explanation for the increased interest citizens have in the central areas. A high number of citizens visit the central area on a regular basis and are therefore well acquainted with it. Many visitors in the area also create issues regarding to e.g. congested traffic, populated green areas or litter. This can for instance frustrate people leading them to leave negative comments there.

Most of the areas with response rates over 10 are found along the coast. Many of the areas in the city of Helsingborg, but not located along the coast, received low response rates (almost none of them surpassed 5 responses per 1000 citizens). Areas such as Eneborg, Högaborg or Drottninghög are all areas with low response rates. These areas also generally experience high unemployment and low income (see Appendix A). The low income and high unemployment

might be an explanation for the low response rate, as people living there may not have the same knowledge or interest in urban planning. Another explanation could be that people from other parts of the city have no interest in these areas. The reason why they may not visit the areas is that high unemployment and low income often correlates with high crime (Grabmeier, 2002). However, there are exceptions, such as Mariastaden. The unemployment rate is low and income level is high (see Appendix A) but the area still did not reach any notably high response rates. Another explanation for this pattern could be that it is mostly the older parts of the population whom participate in the consultations (this have already been established in the thesis). Average age for areas such as Norr and Råå is significantly higher than in e.g. Drottninghög or Mariastaden.

Results also show that many of the areas with high response rates are close to each other. This might be explained by the interest of citizens. Closer to the city centre means more visitors as more citizens have more interest the close to the sea. Not in my backyard (often referred to as NIMBY, or NIMBY-syndrome) as an idea that people to want heavily impacting change, tall buildings, hazardous (but important) plants, however not close to where they live (NIMBY, 2017). This can also be an explanation, as people do want their central area to be changed, but not the area where they live which can be far away from the city centre.

Lastly, areas outside of Helsingborg receive a lot less attention than the city of Helsingborg. The only areas outside the city of Helsingborg that received response rates over 10 were Allerum and Mörarp. An explanation could be that spatial extent of Stadsplan 2017 is the city of Helsingborg. It is not its purpose to affect the rest of the municipality. The reason why areas such as Mörarp, despite this, received higher response rates could be that this analysis, is very dependent on few citizens leaving a lot of comments. This might be the case in Mörarp, where several citizens left very similar comments regarding need for apartments in close vicinity to each other, affecting the general result.

5.2.2 Hotspot analysis

The results show that Dalhem, Söder and Mariastaden are the areas where negative comments had strongest statistical significance. Therefore, these areas are in the most urgent need of revitalisation. Both Söder and Dalhem are characterized by relatively high unemployment

and relatively low-income rates (see appendix A), and can be defined as “troubled areas”. However, Mariastaden is a bit different. The unemployment is relatively low and income is relatively high. An explanation to the lack of a pattern might be that data volumes in each of the areas vary significantly. Therefore, in an area such as Mariastaden, only few entries could have influenced the outcome to a vast extent. Another example of this is Mörarp, where very few entries were left and a strong majority of these entries were entries regarding a need for new housing. This resulted in Mörarp being classified as an area in substantial need of improvement, but in reality, just a few entries requesting new type of housing.

The three areas with high statistical significance of negative entries can have a geographical explanation. The results from the hotspot analysis show that people are generally more content (leaving more positive comments) closer to the sea, than further in-land. An exception to this pattern is Centrum, to which explanation can be found regarding the volumes of data and visitors in that area. None of the three areas, Dalhem, Söder and Mariastaden, are located close to the sea, which is one of the few things these three areas have in common. The will to change their own situation, by planning, might be affected by factors such as need for shorter travelling times to the city centre or the sea. Another explanation can be that their perception of the officials not doing enough for them, rather officials are just focusing on the coastline of Helsingborg. People being more content by the coast is harder to explain, however, their fear of losing the perks of leaving by the sea (such as the view or close vicinity to water) might be an explanation why changes are not needed here.

Interestingly, results from the hotspot map shows that the most prominent hotspot and the most prominent cold spot in the city are located right next to each other. An explanation of this can be related, again, to the interest in the main core of the city. Citizens travel to work or for shopping there, resulting in e.g. congestions. Whereas just northeast, not as many offices or shops are located, the congestions or litter might be smaller, and more people are content with these areas.

5.2.3 The framework of evaluation and the GIS-analysis

This section aims to bridge a gap between the two main parts of this thesis: the framework of evaluating participations and the GIS-analysis. Most important connection is the possibilities

that PPGIS gathered data gives in terms of post-processing. None of the GIS-analysis would be possible if the data collected were not spatial. No data gathered from public meetings were used in the GIS-analysis. Furthermore, as the results show, a high volume of data was gathered using the PPGIS as a participation method. The high volumes allowed GIS-analysis, giving answers not only to what the citizen's opinions are, but also where the opinions are spatially located. Lastly, the fact that PPGIS-tools used required a standardized answer (such as "Good idea" or "I have a better idea") gave excellent possibilities to make statistical GIS-analysis, as each point then had a value. Comments from public meetings are not standardized, as the format is often longer discussion, rather than standardized forms to fill.

5.3 Limitations

The framework used for the evaluation of the two methods has limitations. Frewer and Rowe emphasizes that there are few attempts made in the scientific community to create formalized frameworks for evaluating participation methods, and that this framework is just another attempt. As no standard is present, this framework might be irrelevant in subsequent years, as another, improved framework might emerge. The framework, and this thesis, does not identify for contextual and environmental factors, which might affect the results from the evaluation. Factors that have not been discussed in this thesis are national political styles, the role of the government in public participation or local mechanism that can affect public participation.

The GIS-analyses also has its limitations. For example, the citizens might have randomly placed points inside of Helsingborg meaning that the entire city needs to be improved, or is not in need of any improvements. In some cases, users might want to leave a comment such as "Do not touch our allotments" or "More free parking lots in the city". Such comments might not always refer to the exact area where they are placed (e.g. some respondents may place comments in the harbour, or drop them on random locations in the city, in the interest of quickly getting comments to the officials). This adds a "randomizing-factor" to each of the areas taken into consideration. Furthermore, due to the issues with exact placement, or failed attempts, data may have been altered, which may have influenced my results. This might result in e.g. the Centrum area not being as negatively commented as the data might show, as many of the points there actually might account for the surrounding areas, or the entire city.

Same goes for the response rates. These might not be as high in the city centre as many citizens might just pointed out a specific area there, but referring all the surroundings areas as well. However, I believe that the patterns from the GIS-analyses would not be heavily affected by technical errors or different interpretations of purposes from the respondents. This is due to the fact that officials responsible for this data were surprised over the low amount of irrelevant comments (Pettersson, 2017). Additionally, studies show that respondents with high familiarity with of the area are likely to leave comments in correct areas (Brown, 2012). Finally, the structure of the PPGIS-tools required several steps to leave a comment, as well as a clearly visible option to delete failed comment (own finding).

The hotspot analysis required a specific search radius. The one chosen for the method were 500 meters. With the chosen search radius, the analysis did include at least one neighbour for all relevant data points each of the data. It screened the most irrelevant, isolated points which did not need a hotspot analysis. The method I chose to use were an optimized hotspot analysis (based on Getis-Ord G_i*). Other alternatives, such as Moran's I could have been employed, giving a different result. However, Getis-Ord G_i* provided a sensitive result, showing also rather small and isolated but dense groups of features, as results. This combined with the smaller search radius than the defaults, gave a clearer picture of where both larger and smaller cluster of highly significant points could be found. The mapping of hotspots required to defined what statistical significance is, in terms of confidence. I chose to assume 95 % confidence as statistical significance, as it is common practice. However, a lower confidence (e.g. 90 %) would have resulted in more results to analyse. Furthermore, the calculation of what areas are in most need of revitalization is based on a mean from hotspot analysis, calculated on an administrative level. This means that the sample sizes affect the outcome. An administrative area can contain large clusters of both negative and positive entries. A mean of the entries may result in an area without any high significance. However, if the analysis would be based on smaller areas, the two clusters might have been shown as significant in to the results. The hotspot result could also have been evaluated, studied, overlaid or combined with other data, giving new patterns to study. However, this was not possible to include in the scope and purpose of this thesis.

5.4 Conclusions

This section is an attempt answer to the research questions identified at the beginning of the thesis. Each question is presented, along with the conclusion regarding that specific question right underneath.

The first question follows

Is PPGIS a more effective method for urban land-use planning regarding collecting opinions from the citizens, compared to traditional public participation methods?

- The results show that, accordingly to the used Framework for evaluating participation method, PPGIS is a more effective method. Employment of PPGIS as participation method strengthen the democratic values, as more citizens feel comfortable to leave comments or have better possibilities to do so. This leads to more diversity in the responses. Also, the trust for the planners may rise, as more people have expressed their opinion.

The second question follows

Is PPGIS a more effective method for urban land-use planning as a planning decisions support for new housing establishments for urban planners, compared to traditional public participation methods?

- Yes, in general the results of the framework show that PPGIS gives the planners possibilities to early involve citizens, is cost-effective in relation to the volumes of data, the data is easily assayable using GIS. The planners can gather higher volumes of data, from more diverse sources. Subsequently, PPGIS gives possibility to see new patterns using GIS-analyses, as the gathered data is suitable for this. PPGIS can also warn the planners early on serious matters (such as housing on allotments) or questions which may been missed otherwise (apartments in Mörarp), as they're not within the studied area. Lastly, the combination of several participation methods (e.g. public meetings and PPGIS) can give a better picture of what is needed in the city, since all mainly interested groups in the society are given the opportunity to participate.

The last questions follow

What areas of Helsingborg are in in most urgent need of revitalisation, according to the citizens?

- Certain areas were found which, accordingly to a statistical analysis of the PPGIS-collected data, need revitalisation. These areas are Mariastaden, Söder and Dalhem. Several areas are experienced as good, accordingly to the citizens. Such areas are for instance Tågaborg S, Stattena or Olympia.

- The patterns of these analyses give the planners geographical patterns to work along. Furthermore, this analysis shows in what areas planners should dig deeper in the collected data to explore what needs to be done to improve these areas. Patterns regarding similar action needed in different areas is yet another example what implications this have for the planners. Suggestions for improvement in the three areas in need of revitalisation may have left in other areas as well. Efforts for these comments can be co-ordinated for an effective handling.

The thesis tested the hypothesis that PPGIS is a more effective participation method that public meetings, according to the chosen frameworks criteria. The conclusion is that PPGIS is a more effective participation method on almost all tested criteria than public meetings. On no criteria were public meetings more effective than PPGIS.

5.5 Further studies

A possible approach on further studies is to study each of the classification types of the comments (examples of types are: green areas, housing, traffic, education etc.). An approach where other classifications of the data are studied, may give the officials an idea which approach is needed in what area of Helsingborg.

There are several areas where PPGIS as a participations method needs to be studied and evaluated. Attempts, like Frewer and Rowe's, are needed to develop satisfactory evaluation framework. What Rowe and Frewer presents is just an attempt. Other factors, such as more

national political styles, the role of the government in public participation or local mechanism that can affect public participation, types of participation or the subjective opinions of the users regarding the tools, can be taken into consideration in further studies.

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Appendix A

Area	Unemployment rate in %	Avg. annual income in thousands kr	Avg. age
001 Norr	4.23	434.9	52.5
002 Tågaborg N	5.3	447.7	43.1
003 Tågaborg S	7.62	345.8	41
011 Stattena	7.97	327.1	42.6
012 Ringstorp	7.08	347.9	43.7
013 Berga	9.21	311.0	41.8
014 Mariastaden	4.16	450.5	34.5
021 Fredriksdal	15.41	282.0	39.1
022 Drottninghög	19.15	260.2	33.1
023 Dalhem	14.26	294.7	37.8
031 Olympia	8.73	365.6	43
032 Slottshöjden	7.65	343.4	47.8
033 Centrum	4.97	383.5	47
041 Söder	14.43	276.3	39.9
042 Eneborg	15.42	275.2	36.8
043 Högaborg	17.91	277.9	37.2
044 Närlunda	16.13	285.9	40.8
051 Wilson park	8.21	393.5	42.5
052 Husensjö	5.32	380.2	40.2
053 Fältabacken	4.96	385.9	37.2
054 Sofieberg	3.99	389.8	43.4
055 Rosengården	9.38	320.9	43.2

056 Adolfsberg	13.35	299.5	40
061 Eskilsminne	3.16	409.4	38.2
062 Elineberg	14.23	290.7	45.9
063 Ramlösa	4.15	407.7	38.7
064 Gustavslund	3.39	398.1	38.2
071 Planteringen	21.03	267.9	36.3
072 Miatorp	12.34	307.8	41.6
081 Högasten	12.67	308.2	43.2
082 Råå	3.1	434.0	49.1
083 Ättekulla	6.03	346.0	44.1
190 Hittarp-Laröd	3.28	485.6	40.2
191 Allerum	3.48	355.9	37.9
192 Kattarp	8.85	322.0	40.7
193 Ödåkra	7.45	342.6	38.7
194 Mörarp	5.93	331.8	38.2
195 Påarp	5.53	335.3	40.3
196 Bårslöv	8.01	326.3	38.1
197 Gantofta	3.93	359.6	41.3
198 Vallåkra	5.24	340.0	40.5
199 Rydebäck	2.89	420.1	40.8
Other	16.86		
Helsingborg	8.71	356.7	40.8

Source: statistik.helsingborg,se, 2017

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