Amsterdam: the European playground for tourists

HOW CAN THE INTERNET OF THINGS BE USED TO MANAGE OVERTOURISM?

university of groningen

Colophon

Title:	Amsterdam: the European playground for tourists
Subtitle:	How can the Internet of Things be used to manage overtourism?
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1. Summary

In contemporary Amsterdam, overtourism is a relevant topic. The problem is mentioned in the news daily and residents of Amsterdam want the situation to change. The World Tourism & Travel Council has offered five strategies that could be used to solve overtourism. In this research the role that the Internet of Things could potentially play in managing overtourism in Amsterdam is researched. This research was conducted by the studying of academic literature, research- and strategic documents of the municipality of Amsterdam, and primary data that gave insight into the behaviour of international tourists in Amsterdam. Based on these data it was concluded that the Internet of Things can play a substantial role in managing overtourism in Amsterdam. This can be accomplished when the Internet of Things is integrated in the strategies offered by the WTTC, and is then used as a collect and supply data. With this data, the strategies offered by the WTTC can be realized which will potentially achieve the balance in tourism to be restored. This way, sustainable tourism is achieved and the quality of Amsterdam as a place for residents and tourists will increase.

2. Introduction

2.1. Background discussion

Overtourism is a highly relevant topic in contemporary news. Postma and Schmuecker (2017) state that public discussion on issues like mass tourism and overtourism typically start when the consequences of these phenomena become visible in a public conflict. This is also what happened in the case of Amsterdam in the Netherlands. As a growing amount of people in Amsterdam had complaints about tourists in Amsterdam, the topic was mentioned more often in the news. The city of Amsterdam, the municipality of Amsterdam, and the metropolitan region Amsterdam (MRA) are presented in a map in figure 1.

The word "overtourism" was first used on Twitter in august 2012, but the use of the term grew massively in 2017 as the complaints of residents about tourism worldwide started to grow in number (Responsible Travel, 2018). The amount of news articles that elaborated on problems caused by overtourism in the city of Amsterdam grew quickly and will be discussed in this background discussion.

First, it can be concluded from the news articles that the problem of overtourism in Amsterdam is broad. Citizens are the victim of nuisance caused by tourists that are under influence of alcohol and drugs. This has caused the social coherence of many neighbourhoods to diminish. This problem is worsened because of the increasing amount of apartments that are rented out via Airbnb all year (Deutsche Welle, 2017; The Guardian, 2017; De Volkskrant, 2017). The residents of tourist neighbourhoods sometimes feel as if "they are visitors in their own neighbourhood" (The Guardian, 2017). Residents complain that some of the tourists act as if Amsterdam is one big playground, causing much annoyance amongst the citizens (The Telegraph, 2016; ABC News, 2017). The Responsible Tourism Partnership argues that tourism has come to the point where both the tourist and the resident are dissatisfied (Responsible Tourism Partnership, 2018).

Second, some of the news articles hold AirBnb accountable for problems that have emerged in Amsterdam's real-estate. The problem is considered to be two ledged. Firstly, it argued that the renting out of apartments via Airbnb causes house prices to spiral upwards and hereby drive residents away. Secondly, it is argued that the renting out of apartments via AirBnb is the cause of the growing housing shortage of the city. It has led the municipality of Amsterdam to take measures: apartments can only be rented out 60 days per year in 2017. This maximum will be reduced to 30 days per year starting 2019 (The Guardian, 2016; Deutsche Welle, 2017; Het Parool, 2017; NOS, 2018a). The Guardian writes about the "Airbnb effect", which would be the cause of the rising property prices and communities that are being disrupted (The Guardian, 2016).

Lastly, there is the problem of a diminishing amount of resident facilities. Because of the increase in number of tourists that visit(ed) Amsterdam, the number of tourist shops has increased considerably, causing normal convenience shops to be driven out of the centre of the city (The Guardian, 2017). This has been the reason for the municipality of Amsterdam to cap the construction of new tourist shops in the historical centre and busy shopping streets (Deutsche Welle, 2017; The Guardian, 2017).

Postma and Schmuecker (2017) argue that the solution for the problem of overtourism is sustainable tourism. Sustainable tourism is accomplished when a suitable balance between economic, environmental and social aspects of tourism growth is established. This will then guarantee the long-term sustainability of the touristic sector of a place, city or country.

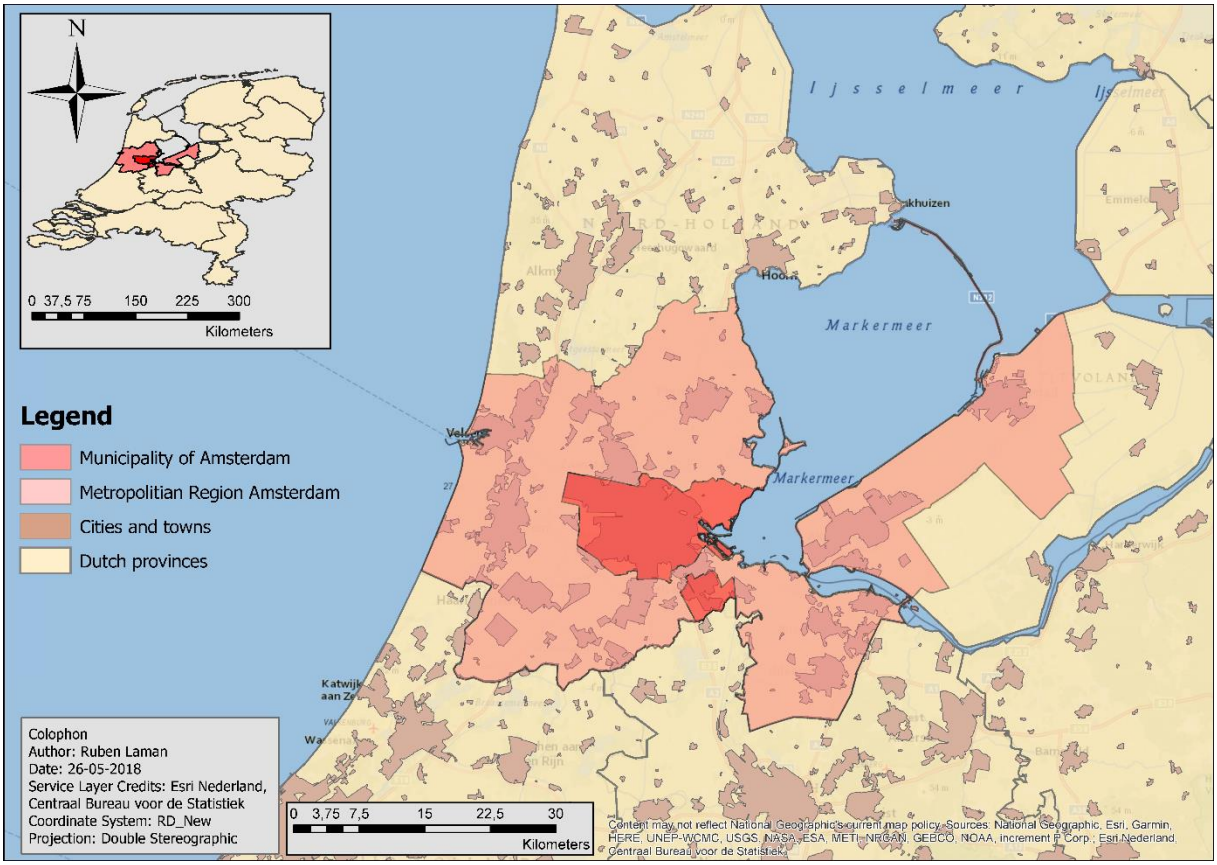

Figure 1: the municipality of Amsterdam and the metropolitan area of Amsterdam on regional and national scale.

2.2. Research problem

Based on the problems described in these articles it can be concluded that the problem of overtourism is considerable and urgent. The fact that Amsterdam expects the amount of overnight stays by tourists that visit the city will grow to 23 million by the time of 2030, which is an increase of 28% compared to 2016, also indicates that Amsterdam has a urgent problem that has to be solved.

The World Travel & Tourism Council or WTTC, published a report in December 2017 named 'Coping with success: Managing overcrowding in tourism destinations'. The report "sets out a framework for analysing what is variously known as 'overcrowding', 'overtourism' or 'tourismphobia'", and "attempts to cut through the media hype around the issue, to understand the nature of the problems at hand, and identify solutions which can make a real difference" (WTTC, 2017). The report focuses on five types of problems associated with tourist overcrowding. These are: alienated local residents, a degraded tourist experience, overloaded infrastructure, damage to nature, and threats to culture and heritage.

In order to find solutions for tourist overcrowding in a city or destination, the WTTC suggests five strategies that can solve the problem:

1. Smooth visitors over time.
2. Spread visitors across sites.
3. Adjust pricing to balance supply and demand.
4. Regulate accommodation supply.
5. Limit access and activities.

These strategies are clear and seem to be appropriate for the problem of overtourism. The way in which the strategies can be implemented is also discussed in the report. Yet, it is rather interesting to find out whether there is a way in which the suggested strategies can be strengthened or their implementation can eased. In their strategic agenda 'Tourism in the MRA 2025' released by the Metropolitan Region Amsterdam in 2014 mention the influence that technological developments such as the Internet of Things can possibly have on tourism (Metropoolregio Amsterdam 2014). This will be central in this research. According to Borgia (2014: 1), is the Internet of Things (IoT) "a new paradigm that combines aspects and technologies coming from different approaches". These approaches are concerned with the internet, sensing technology and communication technology. Borgia (2014) states that when these technologies are put into everyday objects, these objects become smart and are therefore able to gather data about the environment and interact with, and control the physical world.

In order to make the problem stated above researchable are the strategies for overtourism suggested by the WTTC divided into two categories: strategies concerned with tourist behaviour and strategies concerned with government measures. The strategies themselves and examples of them are discussed in the theoretical framework section. In this research is the city of Amsterdam central. Therefore, the government that is concerned with these measures is the municipality of Amsterdam. Thus, from now on the term municipality measures will be used.

The concepts of overtourism and the Internet of Things are relatively new and academic literature that covers these subjects is thus not comprehensive. Particularly academic literature that covers both subjects is rare.

In this research the role that the Internet of Things can play in managing overtourism in the city of Amsterdam will be researched. This will be done by studying academic literature; policy-, research- and strategic documents; news articles regarding tourism in Amsterdam, and primary data on tourist behaviour. A main research question is formulated below. Sub research questions that will be used to answer the main questions are also formulated below.

Main research question

What role can the Internet of Things play in managing overtourism in the city of Amsterdam?

Sub research questions

1. To what extend are the strategies for solving overtourism offered by the WTTC applied in Amsterdam?
2. How can the Internet of Things be used to influence tourist behaviour?
3. How can the Internet of Things be used in municipality measures?

2.3. Structure of thesis

In this first section, a summary of this research was given. In section 2 an introduction to this research was given by discussing the background of the problem, a formulation of the research problem and the formulation of a research question, and three sub research questions. In section 3, a theoretical framework is laid out that explains different theories regarding the concepts and it explains their relevance to each other and to the research. In section 4 a conceptual model of the research design is presented. In section 5 the methodology of this research is discussed. The methodology section will contain an elaboration on how the primary and secondary data that was used in this research was collected and for what research questions the data was used. There will also be a reflection on the quality of the data. In section 6 the results of the research are discussed. The results will be structured according to the sub research questions . In section 7 the conclusion of this research will be given based on the results that are discussed in section 6. After the conclusion the references will be present in section 8. Finally the appendices are presented in section 9.

3. Theoretical framework

In this section the theories that form the foundation for this research are summarized and their mutual relations are discussed. First, academic literature regarding the problem of overtourism is discussed. Second, the strategies for solving overtourism that have been suggested by the WTTC are discussed. Third, academic literature oriented on tourist behaviour and municipality measures is discussed. Fourth, academic literature regarding the Internet of Things is discussed.

3.1. The problem of overtourism

Postma and Schmuecker (2017: 14) have tried to "clarify the mechanisms of conflict between residents and tourists and to propose a conceptual model to assess the impact of such conflicts on city tourism and to suggest a framework to develop strategies to deal with such conflicts and mitigate negative impacts." They state that there seems to be direct and indirect effects of the increase in visitors on the increase of annoyance amongst residents, which can lead to conflicts between these actors. They argue that tourism can have a positive outcome as it brings capital to a tourist destination, but that these positive effects diminish when the tourism growth does not take place in a sustainable way (Postma & Schmuecker, 2017).

The authors' main finding is that there are two mechanisms central in citizens' irritation caused by tourists. These are: (1) cultural distance, which is the cultural difference between tourist behaviour and what citizens think is acceptable behaviour, and (2) spatial and temporal distribution, which is the distribution of tourists over time, that can cause overcrowding and irritation. The solution for overtourism according to Postma and Schmuecker is sustainable tourism. The importance of the spatial of the spatial and temporal distribution of tourists will be developed in the following sections.

According to Bock (2015), conflicts between residents and tourists can occur when tourists have nightly parties in residential areas. Furthermore, a conflict emerges when local stores, pubs and markets are transformed into tourist-oriented locations that become unaffordable for the local resident. The first conflict is related to the discussed cultural distance as mentioned by Postma and Schmuecker.

Goodwin (2017) defines overtourism as a phenomenon that arises in places or locations where hosts, guests, locals, visitors, or all of them, feel that there are too many visitors and that the quality of life in the area, or the quality of the experience has deteriorated unacceptably. He argues that the solution for the problem is 'responsible tourism'. Responsible tourism leads to places that are better to live in and visit. Responsible tourism as described by Goodwin can be compared to sustainable tourism as described by Postma and Schmuecker. Both stress the importance of the quality of the places where people have to live. In this research the term sustainable tourism will be used.

3.2. WTTC suggested strategies to solve overtourism

As discussed in the research problem of this research, has the WTTC (2017) developed strategies to solve overtourism. The WTTC states that in most cases, an approach where multiple solutions are integrated has the largest change of being effective. For the sake of this research the strategies have been divided into two categories; (1) strategies oriented on *tourist behaviour* and (2) strategies oriented on *municipality measures*. A brief discussion of these strategies and what they account for is given.

Tourist behaviour oriented strategies:

1. Smooth visitors over time

When a tourist destination suffers from an imbalance influxes of visitors, it can help to sustain balance by smoothing visitors over time. This can be done over the year, week, but also over the day. This will potentially prevent a degraded tourist experience, overloaded infrastructure, and threats to culture and heritage. This smoothing can be done by introducing a cap, which will be discussed in the solution 'limit access and activities', or by nudging visitor behaviour using ticket systems, real-time data, and promotion strategies (WTTC, 2017).

2. Spread visitors across sites

The smoothing of visitors over time works best when its combined with spreading visitors across sites, or geographically. This is different on a country scale compared to city scale. This spreading can be done over both existing sites as new destinations. A problem with this approach is that first-time visitors are less willing to visit 'new destinations', as they most probable want to visit the must-visit sites. For the spreading of visitors over new sites, it is therefore better to focus on repeat visitors (WTTC, 2017).

Municipality measures oriented strategies:

3. Adjust pricing to balance supply and demand

In order to balance the amount of visitors, adjustments or regulations in pricing can be set to balance demand and supply. In most cases it is likely that higher prices will limit the amount of visitors. Thus, when a certain attraction or site is more expensive to visit, less people will visit it. By finding a right balance between price and amount of visitors, a state of optimality can possibly be reached. Yet, it is important that the adjusting of prices is done in a collaborative and transparent way, otherwise reputations can be damaged and trust might be lost (WTTC, 2017).

4. Regulate accommodation supply

The regulation of accommodation supply measure largely speaks for itself. In order to find a better balance in the amount of visitors that visit for instance a city, regulation in the supply of accommodation can potentially help reaching this balance. A municipality can for instance stop handing out licenses for the construction of new hotels. The regulation of accommodation supply has become a difficult measure due to the popularity of the sharing economy. It is however possible for the municipality to regulate this by taking measures. Though, the control on whether or not the regulations are followed is a more difficult task (WTTC, 2017).

5. Limit access and activities

The most rigid measure that can be taken is the limiting of access to places and allowed activities. This is most effective when there is a problem of alienated local residents, damage to nature, and threats to culture and heritage. Some examples of such measures are the banning of drinking alcohol in public, or the opening of new souvenir shops or activities aimed at tourists. The WTTC stresses that actions in the forms of bans should be a last resort after consolation with stakeholders, as they might hurt the tourism branch (WTTC, 2017).

3.3. Tourist behaviour oriented

In this section, literature on tourist behaviour and how this can be influenced will be discussed. The WTTC strategies that the discussed literature supports are: (1) smooth visitors over time, and (2) spread visitors across sites. Two ways in which tourist behaviour can be influenced are by managing them and by influencing their behaviour. An important aspect that is needed to support these actions, is data.

Mrazovic et al. (2017) mention the twofold problem of: (1) planning a trip in an unfamiliar environment where a tourist wants to visit certain points of interest, and (2) a government that tries to manage tourist flows. In order to solve these problems, data is needed. The data that is needed consists of information about the movements and the flow of decisions of people, and can be used to improve efficiency, sustainability and quality of life for residents and tourists (Batty et al., 2012; Boes et al., 2016).

A highly important actor for the creation of this data are wireless technologies such as Global Positioning System (GPS), and mobile phone networks. These network infrastructures have enabled the collection of spatial-temporal data. With this data, human mobility can be better understood, predicted, influenced and therefore managed (Batty et al., 2012; Bock, 2015). Bock (2015) also states that while in the past people primarily used digital devices before and after their trip, a shift in this has taken place, as people now primarily use mobile technologies during their trip, as many travellers are always connected to the internet. This allows for the collection of data on tourist mobility and touristic preferences.

Based on this data, tourism organizations, but also a municipality can provide tourists with real-time personal services and advices in the form of apps, while they simultaneously collect data that can help optimizing strategy and management (Lin, 2011; Boes et al., 2016; Dameri & Ricciardi, 2017; Wong et al., 2017).

Gretzel has argued that ICTs have led to fundamental changes in tourist behaviour. It can therefore be assumed that tourist behaviour can be influenced by providing services and advices, via for instance a smartphone (Gretzel, 2011).

Boes et al. (2016) also stress the importance of the Internet of Things for the collection, transferring and analysis of large data sets which give insight in the real world. This will be further discussed in the, the Internet of Things section. These real-time personal services and advices can for instance exist of (1) recommendations for points of interest, dining and recreation; (2) enriching tourist's experience by supplying location-based information or services (Gretzel et al., 2015; Rincon et al., 2017; Wei et al., 2017).

It is important that tourists are provided with the information that they are looking for, as they can otherwise have a less positive experience. Feeding tourists with the information they are looking for can be perfectioned by integration of feedback on previous recommendations (Grün et al., 2017).

Almobaideen et al. (2017) developed a program that selects the best route that tourists can take while taking the medical condition of the tourist and thus the medical service that the tourist might need into consideration.

With the discussed possibilities in this section, tourism, both for residents and tourists, can eventually be improved (Wei et al., 2017). Zheng et al. (2017) state that the understanding of tourist mobility plays a fundamental role in the designing of destinations, planning of on-site movement and attraction marketing, it is therefore highly relevant to spatial planning. The authors also state that with the management of tourists, the quality of tourist behaviour and the touristic experience can be optimized.

3.4. Municipality measures oriented

In this section, literature relevant to municipality measures will be discussed. The WTTC strategies that this literature supports are: (3) adjust pricing to balance supply and demand (4) regulate accommodation supply (5) limit access and activities (WTTC, 2017). These approaches are, like the approaches discussed in the tourist behaviour section, mainly rely on data. Literature on data that has been discussed in this previous section is also relevant for municipality measures.

Due to the changing nature of city tourism, tourists are increasingly looking for experiences that make them feel like local residents (Bock, 2015). This results in the confrontation of tourists and local residents, for instance because the use of local resources and amenities by tourists. This contributes to the phenomenon of overtourism. One option for the municipality of a city to intervene in this problem is by imposing regulations. Based on GPS data, it can be established which areas in a city are visited by a high amount of tourists and if this causes problems. It can also be analysed whether certain areas are becoming more or less popular. With this data, strategies and regulations can be developed (Lin, 2011; Bock, 2015). Another possibility for the government is to impose ticket management based on data about tickets sale. This can be used to manage tourist flows.

When the collected data by smartphones is combined with cameras in public areas, this allows for advanced video surveillance. It can be used to guarantee public safety. This can be usefull in cases of overcrowding danger during events that attract many people, or in places that attract many tourists (Borgia, 2014). The monitoring of places also enables real-time crowd controlling. This means that monitored locations can be kept an eye on and when congestion is anticipated, premature warnings or redirections can be given through digital screens (Zheng et al., 2017).

Batty et al. (2012) state that with the collection of data, privacy is not in danger as the information is anonymised through several levels of scrutiny and confidentially. It is important to preserve security and privacy of individuals as spatial-temporal data contains information about their daily commutes and home- and work-locations (Sun et al., 2016). This is also relevant for tourists, because privacy concerns of tourists about their smart phones can influence the tourist's behaviour (Wozniak et al. 2017). Li et al. stress the importance of thinking through the challenges that come with big data and the security of it. This becomes more relevant when integration of the Internet of Things is realized and larger amounts of data are collected and stored (Li et al. 2016).

3.5. The Internet of Things

The concept of the Internet of Things is based on the idea that through the combination of sensing technologies, communication technologies and data computing an integrated system is developed where the real and digital world meet, and are highly interconnected through devices that interact through the internet. The things can be both physical objects such as sensors, digital devices and chips, but also virtual entities that move through time and space (Borgia, 2014; Li et al., 2016).

Because of their interconnectedness, these things are able to collect all kinds of data, but they are also able provide real-time information (Gretzel et al., 2015; Cavalcante et al., 2016). It is expected that the number of connected things will grow to become billions around 2020 (Suzuki, 2017). With these connected things, data can be gathered in enormous proportions.

By becoming interconnected and sharing data, things become smart and are capable of offering controlling options for urban challenges such as managing traffic, monitoring the state of infrastructure, measuring air quality or allergenic pollen. Another possibility is the controlling of visitor numbers at specific sites by making use of different sensors that are connected through the Internet of Things (Lin, 2011; Gretzel et al., 2015; Suzuki, 2017).

These possibilities are based on the assumption that with the Internet of Things, the environment can be understood through the collected information, and based on this information actions can be taken (Díaz et al., 2016). This will improve life quality in terms of safety, health, and wellness (Borgia, 2014). Gretzel et al. (2015) argue that the establishment of the Internet of Things is an important requirement for the services to be provided by smart tourism cities. A smart tourism city is a city that uses smart solutions in its touristic sector. A smart solution is for instance a service that is 'always-responsive', which means that it is provided at 'run-time' and specific to the needs and context of the tourist.

In short, can it be concluded that technical developments in combination with the Internet of Things allow for the collection, transfer and analysis of large data sets. This provides real-time data which can be used for understanding behaviour of tourists. It can also be used for intervening in the tourist experience, by supplying services and advices to tourists (Boes et al., 2016).

4. Conceptual model

In this section the conceptual model (see figure 2) that was central in this research is provided. This conceptual model was designed on the basis of the problem discussed in the introduction, the strategies and theories discussed in the theoretical framework and the solution discussed in the introduction and theoretical framework. This conceptual model has been used to keep an overview of the aim, and structure of the research.

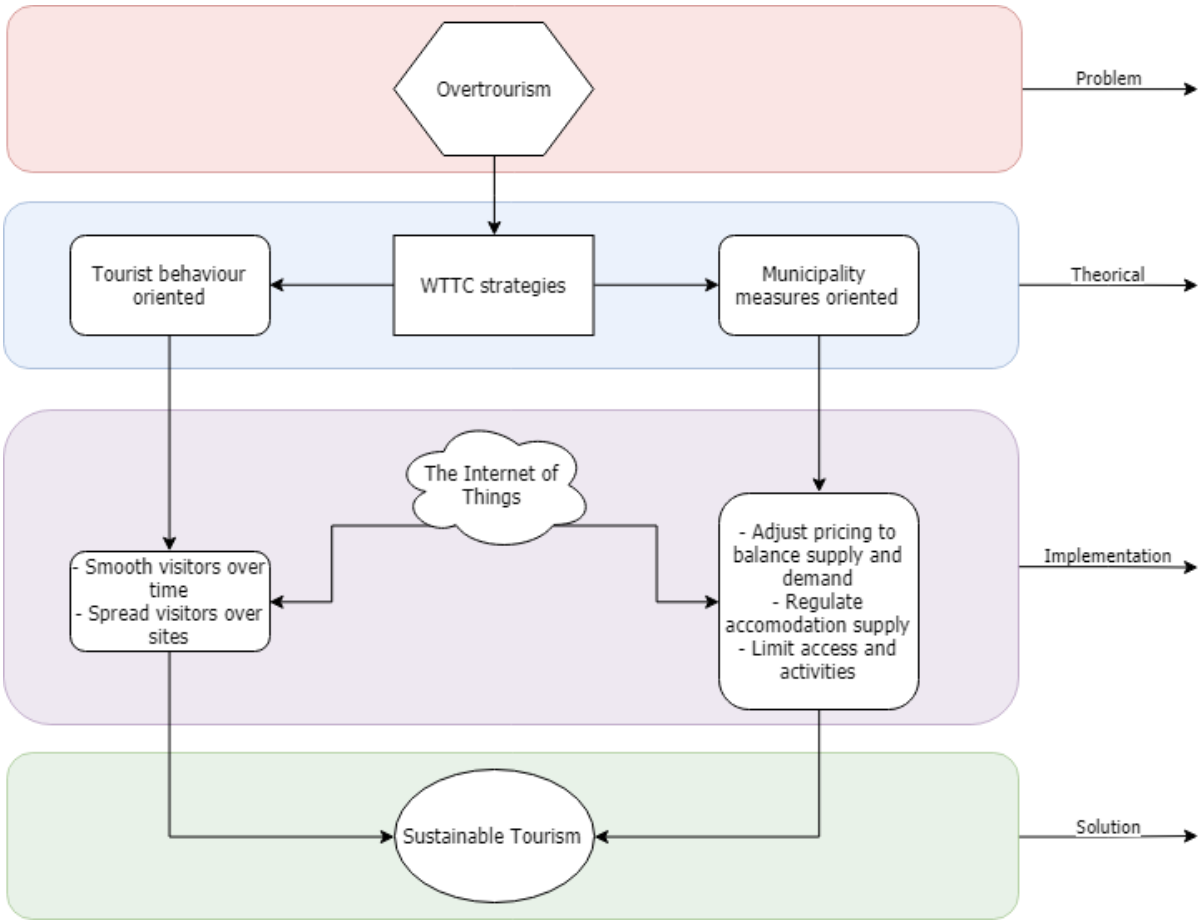

Figure 2: the conceptual model of the research design.

5. Methodology

In this section the methodology of this research is discussed. First, the reasons for why the data that was used in the research are explained. The data will also shortly be discussed. Second, practical information on the collection of the primary and secondary data that was used is discussed. Third, a reflection on the quality of the collected primary data is given.

5.1. Decision selection

Based on the strategies suggested by the WTTC for the problem of overtourism, two categories were established: strategies concerned with tourist behaviour and strategies concerned with government measures.

The aim of the first sub research question is to find out to what extent the strategies to solve overtourism offered by the WTTC are applied in Amsterdam. It was decided that it would be possible to formulate an answer to this question through the studying of policy documents and strategic agendas of the municipality of Amsterdam, as these documents would contain recent information on what is done in the touristic sector. During the studying of academic literature it appeared that examples were given of measures that have been taken in Amsterdam that were relevant to the WTTC strategies. These are therefore used to answer the first sub question. Lastly, due to the fact that overtourism is so relevant and thus measures to reduce the effects of overtourism were published during this research, a news article by the Nederlandse Omroep Stichting that elaborated on the published regulations was used (NOS, 2018b). Unfortunately, this source is not scientific like the policy documents, strategic agendas and academic literature. Despite this, it does add a valuable contribution to the research as is contains the most recent information and because it will be published in an official municipality document in the future.

The aim of the second sub research question is to find out how the Internet of Things can be used to influence tourist behaviour. In order to gain an understanding of the possibilities for the Internet of Things to influence tourist behaviour, secondary data in the form of academic literature was studied. To gain insight into whether tourists are willing to be influenced in their behaviour, data on this subject was necessary. Clifford et al. (2010) argue that survey questionnaires can be used to get insight into people's opinions and behaviour. It was therefore decided to conduct a survey questionnaire amongst international tourists in Amsterdam. Practical information on the way in which this survey questionnaire was carried out is discussed in section 2 of this chapter.

The aim of the third sub research question is to find out how the Internet of Things can be used in municipality measures. In order to gain an understanding of the possibilities for the Internet of Things to be used in municipality measures, secondary data in the form of academic literature was studied. The findings from studying the literature where then partially substantiated by data from the survey questionnaire.

5.2. Data collection

In this section practical information on the collection of the used data is discussed. This section will be structured based on the two categories, primary data and secondary data.

5.2.1. Primary data

The primary data that was used in this research was collected by the carrying out of a survey questionnaire amongst international tourists in Amsterdam. The survey questionnaire was carried out in order to find out if it is possible to influence tourist behaviour by gaining insight in their opinions and behaviour.

Amsterdam Marketing conducts a research into tourism in the metropolitan region Amsterdam every 4 years. In their research from 2016 they concluded that 17% of the tourists that visit Amsterdam are of the Dutch nationality. Furthermore they conclude that 83% of the Dutch tourists only stay for one day, and thus go home at the end of the day (Amsterdam Marketing, 2016).

Based on this it was decided that the focus for the survey questionnaire had to be on international tourists as this was presumably the main group that causes overtourism, and thus the WTTC strategies should be applied to.

The survey questionnaire can be found in the appendixes as appendix A. Clifford et al. (2010) discuss the different methods that can be applied in the carrying out of a survey questionnaire. Face-to-face interviews are argued to be appropriate for any type survey questionnaire as it is the most flexible survey strategy. It allows for the clarification of answers to open-ended questions. The personal contact between interviewer and interviewee is also argued to have a positive influence on the response rate. Other possibilities for the carrying out of survey questionnaires are telephone interviews, postal surveys, drop and pick-up questionnaires and internet surveys. These approaches have been considered but where left out because it would be virtually impossible to contact the target group of international tourists in Amsterdam.

Based on the discussed information and considerations above, it was decided that the survey questionnaire would be carried out in the form of face-to-face interviews. The main advantage of this approach was the possibility to identify whether people were international tourists or not. This was performed by asking them if they (1) spoke English, and (2) was a tourist.

The sample group from the survey questionnaire has the aim to represent the population of international tourists in the city of Amsterdam. According to Amsterdam Marketing, Amsterdam was visited by 17 million people in 2015 and this number is expected to grow in the coming years (Amsterdam Marketing, 2016). The group of international tourists consists of all tourists minus Dutch tourists, thus $17.000.000 - (0{,}17 \times 17.000.000) = 14.110.000$ international tourists. In order to gain a sample from this group, the survey questionnaire was carried out at the touristic attraction ‘the Dam’ square. The location is a popular tourist attraction due to the presence of the Royal Palace Amsterdam, the ‘Dam’ statue and the Madame Tussauds Museum. It was decided to collect a sample size of 70 survey questionnaires. This would allow the testing of the sample on representativeness to be done with a confidence interval of 90% and a margin of error of 10%.

The survey questionnaire was carried out in the month of May. It was decided to carry it out in May because the Dutch weather is warmer and sunnier and thus more tourists would be outside and the square would thus be busier. This eased the process of finding a sufficient amount of international tourists that were willing to participate in the survey questionnaire.

For the collection of the survey questionnaire, the random sampling method was used. People were selected at random and asked whether they were willing to participate in a research into tourism in Amsterdam. If they were willing to participate, they were asked if they spoke the English language. If they met this requirement, by answering yes, they were asked if they were a tourist. If they met this requirement, by answering yes, then the survey questionnaire was carried out.

The international tourists were sampled as described above. The survey questionnaire started by the handing over of a printed version of the questionnaire. The participants were asked to carefully read the questions and then say their answer out loud. If they were not willing or unable to give answer to a question, the question was left blank. It was also explicitly stated that the research was completely anonymous and that their answers would only be used for the purpose of this research, and thus treated as confidential. The answers were then filled in on an online version of the questionnaire by the researcher. This way it could be guaranteed that no questions were skipped accidentally or answers were filled in wrong. Clifford et al. (2010) mention the importance of an ethical approach when participants are involved in a research. The information mentioned above ensures this ethical approach. A reflection on the quality of the data that was collected via the survey questionnaire will be discussed in the final section of this chapter. The data that was collected via the survey questionnaire was analysed in the statistical analysing program SPSS. The findings from this analysis are used to substantiated the findings that are discussed in the results section. The results from the test are present as tables in appendix B.

5.2.2. Secondary data

The secondary data that was used in this research was collected via the internet and consists of academic literature; policy-, research- and strategic documents; and news articles. In this section, per type of data will be discussed why it was selected, how it was selected and how it was analysed. Also the quality of the data will shortly be discussed.

Academic literature

The academic literature that is mentioned in this research is used to substantiate different theories regarding the discussed subjects, and to show the relevance of these works to this research. The academic literature was collected via the online library tool Worldcat. For the selection of articles different key-words were defined. The key-words that were used can be found in table 1. This list was added to during the process of studying the literature. By the searching for these key-words and combinations of them, articles that could have a valuable contribution to this research were selected. This resulted in a total of 22 academic articles that were considered to be fitting for this research. The articles were then read thoroughly and the important theories and findings were gathered and connected to each other. In order to guarantee the relevance of the used academic literature, only work published after 2010 was selected. Furthermore, only peer-reviewed articles that referred to other academic literature was selected. This has enabled the collection of academic literature of high quality.

Key-words used for selection of academic literature
Internet of Things (IoT)
Overcrowding
Overtourism
Smart Tourism
Sustainable Tourism
Technology
Tourism
Tourism Management
Tourist Behaviour
Tourist Destination

Table 1: key-words used for selection of academic literature. The terms are ordered alphabetically and their sequence has no other meaning.

Policy-, research- and strategic documents

The policy-, research- and strategic documents that are used in this research were collected through the internet via the search engine Google. The main document that has been central in this research is the WTTC report (2017) that suggests strategies for the solving of overtourism. The other documents that are mentioned have been used to substantiate the relevance of the subject, substantiate the decision to carry out a survey questionnaire and to gain insight into the measures that are taken by the municipality of Amsterdam. As the composition of these documents are either initiated or done by the municipality of Amsterdam, the data can considered trustworthy. All documents that have been used were composed after 2010 which guarantees their relevance.

News articles

The news articles that have been used in this research were primarily used in the introduction to show the relevance of the problem of overtourism. The provided information by the news articles also substantiate the theories regarding overtourism that are mentioned in the theoretical framework. One article that was released by the news platform Nederlandse Omroep Stichting was used for the answering of the first sub research question, as it contained information about new measurers regarding overtourism that will be taken by the municipality of Amsterdam. This article was published in May 2018 and it was therefore decided that it could add a valuable contribution to the research. All other news articles where published in 2016 or later which guarantees their relevance. As most articles publish the same information it has been decided that this their information could be considered to be reliable.

5.3. Quality of the survey questionnaire data

In this section the quality of the data that was collected via the survey questionnaire will be discussed. The quality of the data will be discussed in terms of its usability which has been tested by a statistic test.

In order to test whether the sample of the population of international tourists in Amsterdam was representative and thus of contribution to the research, a one-sample t-test was carried out. The test was carried out based on the amount of days that the participants were staying in Amsterdam. The average number of days that international tourists stay in 2015 was 3,9 days (Amsterdam Marketing, 2016). The average stay of tourists in the sample was 3,6 days.

The null-hypothesis for this test is that the sample size population is the same as the total population. The alternative-hypothesis is that the sample population is different from the total population. The result from the one-sample t-test was that $\alpha = 0{,}307 > 0{,}1$ and thus the null-hypothesis is accepted: the sample size is representative of the population. This result means that the data that was collected via the survey questionnaire can be used to make statements about the behaviour of international tourists in Amsterdam. The outcome table of the test can be found in appendix B.

6. Results

In this section the results of the research will be discussed, structured according to the sub questions. The results are based on the primary and secondary data that has been discussed in the methodology section.

6.1. To what extend are the strategies for solving overtourism offered by the WTTC applied in Amsterdam?

The strategies for the solving of overtourism offered by the WTTC are; (1) smooth visitors over time, (2) spread visitors across sites, (3) adjust pricing to balance supply and demand, (4) regulate accommodation supply, and (5) limit access and activities. The answer to the sub research question will be based on information deducted from policy documents and strategic agendas of the municipality of Amsterdam, scientific literature, and news articles.

Policy documents and strategic agendas

In the year 2014, the metropolitan region Amsterdam (MRA) published the document 'Strategic Agenda Tourism in the MRA 2025'. In the document the importance of tourism for the city and region of Amsterdam are stressed, but also the importance of sustaining a balance, as the centre of Amsterdam is becoming busier because of tourism. One of the strategies that has been developed is called "Visit Amsterdam, See Holland". The goal of this strategy is to encourage tourists to visit other places besides Amsterdam in the metropole region. This strategy is based on the solutions (1) smooth visitors over time, and (2) spread visitors across sites, on a regional scale. The strategy is designed to be a rolling agenda, which means that when new possibilities become achievable or goals have to be adjusted, this is possible. This means that the policies are flexible. De Roo (2013) argues that the flexibility of policies can be both a strength as a weakness. He argues that it can lead to policies being formulated vaguely which will make their realization harder. A strength of flexibility is that it can be used to adopt the policies to emerging changes.

The strategy is considered to be a success as the amount of international visitors that have visited the region of Amsterdam has risen with 23% between 2008 and 2011. Whether the real growth of tourism was considered in the calculation of statistic is unknown, but interesting. The document also states that the goal is to make tourism grow in a balanced and sustainable way (Metropoolregio Amsterdam, 2014; Gemeente Amsterdam, 2011).

A strategy similar to the "Visit Amsterdam, See Holland" strategy has been developed by Holland Marketing and is called "Holland City". It is aimed at encouraging tourists to visit other cities in the Netherlands. It consists of themed lines, such as the "Van Gogh-line" or "Golden Century-line", in which cities are nodes that are considered to be interesting for the theme and thus should be visited (Holland Branding & Marketing Strategie, 2015).

An initiative that supports the spreading of tourists over the metropolitan region of Amsterdam is the realisation of the "Amsterdam & Region Day Ticket". This ticket allows tourists to travel within the region for 1, 2, or 3 days by all means of public transport. Another card that enables tourists to make use of the public transport system is the Iamsterdam city card, although this is only valid within the city itself. It does though, come with free entry at museums, a canal cruise and more. An initiative by public transport supplies Conexxion called "the Industrial Heritage Line" is aimed at getting tourists to visit places in the MRA.

Another project is initiated by the Spatial Planning department of the municipality of Amsterdam called "Groene Lopers", which freely translates into "networks of green". The goal is to develop a network consisting of 9 or 10 cycling routes that connect Amsterdam to the region. This will take pressure away from Amsterdam cycle-wise.

Regarding the supply of accommodation, a "Regional Hotel Strategy" has been established. This strategy is aimed at a better balance in supply of hotel accommodation in the region. As there is a need for new hotels, but there also is vacancy in office real estate, offices are transformed in hotel accommodations. This is relevant to the field of spatial planning.

The WTTC report also mentions an initiative taken by the municipality of Amsterdam in which an experiment was done of displaying the waiting time for touristic attractions on its website. It also states that an app was created that sends information about queues and offers alternative attractions. The report also mentions the capping on the opening of new tourist focussed services and shops in the city centre and the banning of beer-bikes. (WTTC, 2017)

Literature

Bock (2015) refers to Amsterdam as one of the first cities that works on a project aimed at spreading tourist streams that are typically not visited by tourists. Bock (2015) does not officially mention that this is about the "Visit Amsterdam, See Holland" strategy, but this can be assumed as it is the main strategy adapted by the municipality of Amsterdam.

Gretzel et al. (2015) mention Amsterdam as a city that uses smart solutions and refers to possibility for tourists to translate signs by using beacons. Also the Amsterdam Arena is mentioned as it is testing sensors for crowd management.

News article

Because of the rising tensions caused by tourism in Amsterdam, new (and older) regulations have officially been formulated and published by the Amsterdam council in May 2018 (NOS, 2018b). The regulations are not formulated in an official report, but are acknowledged to be implemented. The regulations consist of the following:

- Tourist taxes will increased in order to be 105 million euro in 2022
- Technical possibilities for the "volume-policies" and traffic management will be researched
- Reducing of leisure traffic on water and land; e.g. cycle taxis, segways, beer-bikes, horse-drawn carriages
- More severe enforcement on alcohol use, noise nuisance and recruitment practices
- Reducing of hop-on and -off places for canal cruises
- Hotel policies will be reconsidered
- More severe enforcement on illegal letting of housing
- The passenger terminal for cruise-ships will disappear and no new location will be created
- Hotel boats will no longer be allowed to moor in the city

6.2. How can the Internet of Things be used to influence tourist behaviour?

The WTTC strategies for managing overtourism in which the influencing tourist behaviour is relevant are (1) smooth visitors over time and (2) spread visitors across sites. In the theoretical framework have the possibilities of influencing tourist behaviour been discussed. This, in combination with data that has been collected via the survey questionnaire carried out amongst international tourists in Amsterdam, will formulate an answer to this question.

The two main ways in which tourist behaviour can be influenced are by managing the tourist, and through influencing his behaviour by the supply of services and advices. The Internet of Things can play an important role in both approaches.

For the managing of tourists is it important to have information or data about tourists. It is important that this data is spatial-temporal because with such information it will be possible to understand how the tourist acts in his environment. When this data is combined with the tourists' preferences, strategies can be developed that will help managing the tourists by influencing their behaviour (Batty et al., 2012; Bock, 2015). Thus, in order to develop such strategies, data is needed and this is where the Internet of Things can play a considerable role. With the realization of the Internet of Things, big data can be gathered (Gretzel et al., 2015; Cavalcante et al., 2016; Suzuki, 2017). This data can then be used to support the strategies aimed at influencing the tourists behaviour. In order to gain a further understanding of how the Internet of Things can play a role in the influencing of tourist behaviour, the data that has been collected via the survey questionnaire will now be discussed.

The main need for the realization of the Internet of Things are the digital devices that can be connected via the internet. Of the 70 people that participated in the survey questionnaire, 97% brought at least one digital device with them. Of these people 84,3% said that their device(s) were connected to the internet. 78,6% said that their device(s) were connected to locational services. This potentially means that from every 10 tourists, the data of 8 people can be gathered.

The municipality of Amsterdam aims to spread its visitors over the metropolitan region of Amsterdam through the "Visit Amsterdam, See Holland" strategy as discussed in the previous sub research question. The tourists that participated in the questionnaire were therefore asked if they were interested in visiting other cities in the Netherlands during their stay in the Netherlands. 74,3% of the people said that they would like to do this. It was tested if there was a correlation between the interest in visiting other cities and whether the tourist had visited the Netherlands before. This was tested because the WTTC (2017) suggests that the spreading of visitors works the best when aimed at repeat visitors. In the sample, no significant correlation between these variables was found. The full test results can be found in appendix B.

For the influencing of tourist behaviour through the supply of services and advices, data also plays a primary role. This is because based on this data personal services and advices can be provided, which can be used to influence the tourist to for instance go to a less crowded location. This way of providing services and advices that happen in real-time, thus while the tourist is at a certain location. The other possibility can be that the tourist gives up his preferences and/or attractions that he wants to visit, and based on this information, routes can be set out that cross the least amount of other tourists' routes. This will then result in less crowded locations.

When asked whether people were willing to share some personal information (age, touristic preferences, location, etc.) with the municipality if this would help them to improve their touristic experience, 72,9% answered yes. Tourists were also asked whether they were interested in a service provided by the municipality of Amsterdam that showed them (in real-time) which tourist attractions are busy and which are not. The distribution of their answers can be found in figure 2. Tourists were also asked whether they were interested in a service provided by the municipality of Amsterdam that showed them (in real-time) what route to destinations they could take best (in terms of how busy the different route opportunities are). The distribution of their answers can be found in figure 3.

From the information discussed above, the following can be concluded: (1) the gathering of data and supply of information that is needed for both approaches, can be positively influenced by the realization of the Internet of Things, and (2) there is a possibility to influence tourist behaviour by management and the supply of services and advices, in which the internet of things can play a primary role in the form of collector and supplier of data. From the survey questionnaire it can be concluded that there is a considerable interested in the supply of advices and services by the municipality of Amsterdam.

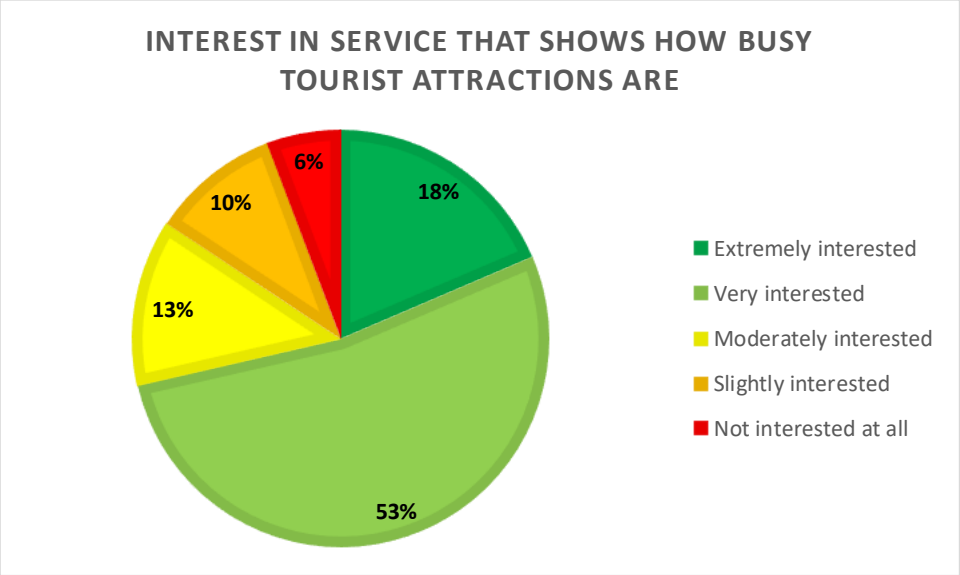

Figure 3: distribution of answers to the question whether tourists were interested in a service provided by the municipality of Amsterdam that showed them (in real-time) which tourist attractions are busy and which are not.

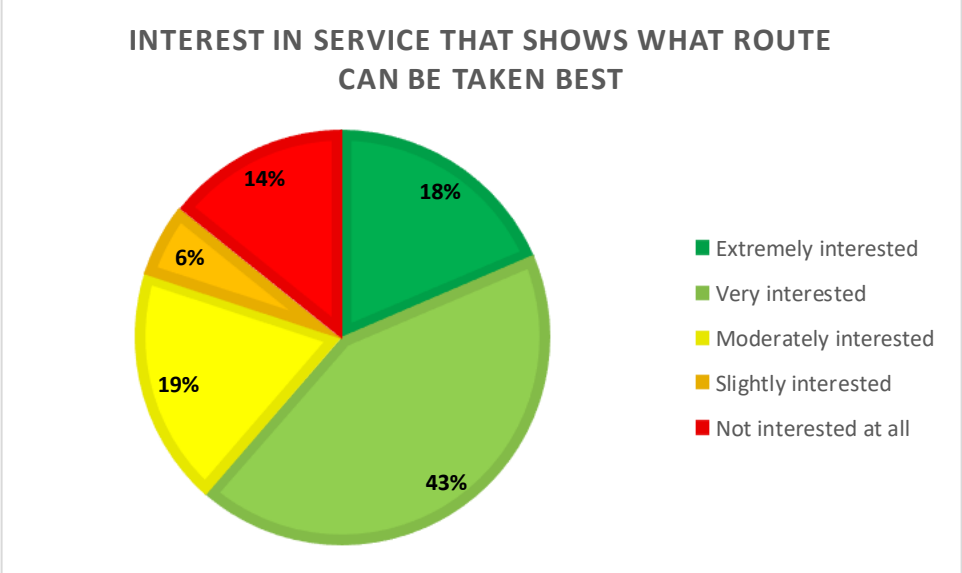

Figure 4: distribution of answers to the question whether they were interested in a service provided by the municipality of Amsterdam that showed them (in real-time) what route to destinations they could take best (in terms of how busy the different route opportunities are).

6.3. How can the Internet of Things be used in municipality measures?

The WTTC strategies for managing overtourism that are concerned with municipality measures are (3) adjust pricing to balance supply and demand, (4) regulate accommodation supply, and (5) limit access and activities. From the academic literature that has been discussed in the theoretical framework can be derived that the main possibilities for the Internet of Things in municipality measures are the supply of data and security monitoring. For both these possibilities, privacy plays and important factor. The possibilities will now be discussed based on the literature and substantiated with the data that has been collected in the questionnaire.

Data based measures

Lin and Bock (2011, 2015) mention the possibility of developing strategies and regulations based on data on tourism. With the realization of the Internet of Things, the collecting and analysing of this data becomes easier. An example that is given is the analysis of spatial-temporal GPS-data that can be used to see if areas are becoming more or less popular, and based on this, well-adapted regulation or strategy can be designed. Another possibility is the application of ticket management based on collected data. Based on information collected about the demand and interest in tickets, a balance in sales and pricing can be sought (Lin, 2011). A difficulty here though is that the municipality of Amsterdam works with businesses that try to maximize their profits and thus might not be willing to make changes to their sales. A way around this could be the imposing of higher taxes, this is also mentioned in the answer of the first sub question. The municipality will increase tourist taxes (NOS, 2018b). The Internet of Things can thus be used in the gathering and analysing of the data in order to substantiate strategies and regulations.

Security monitoring

The second possibility is security monitoring. With the monitoring of security, the municipality can make decisions regarding the regulation of access in real-time. It is hereby possible to warn tourists that are on their way to an area that the area is overcrowded and they can go somewhere else (Borgia, 2014; Zheng et al., 2017). This can prevent the overcrowding of an area. With the realization of the Internet of Things, data that can support for instance live camera footage. Based on the combination of spatial-temporal data collected from smartphones and footage of security cameras, it can be decided whether an area is too crowded and no more people should come to the location. When sensors that measure air-quality or allergenic pollen are integrated in this system, specific warnings for more vulnerable people can be supplied (Borgia, 2014). When tourists were asked whether they were willing to share some personal information (age, health issues, location, etc.) with the municipality of Amsterdam if this would help them guarantee their safety, 65,7% answered yes. When asked why, most people gave an answer that indicated that they thought safety is important. The other main reason that they were willing to share this information was that they had no problem with sharing this data. For the people that answered the question by saying no, the main reason was their privacy. This will be further discussed in following part of this sub question. Another reason that was named multiple times was that the person did not find the guarantee of safety necessary.

Privacy concerns

From the questionnaire could be concluded that the main reason for people not to be willing to share their data was that they value their privacy over their safety. Out of the 24 people that were not willing to share some personal information, 14 people indicated that this was because of their privacy. Also the literature discussed in the theoretical framework suggests that privacy is an important factor, especially for the sharing of data (Sun et al., 2016).

It is therefore important that data is collected anonymously and is securely stored. Batty et al. (2012) state that the anonymity does not have to be a problem because the data is anonymised through the different layers of the collection system. It is thus important that when the Internet of Things is realized and it is used to developed strategies and regulations, and in security monitoring, that people whose data is gathered are well informed about what the data is used for and that the collection happens anonymously.

Thus the following can be concluded. First, the Internet of Things can be used for the supply and analysis of data to support the development of strategies and measures. Second, when the Internet of Things is integrated in a system of security cameras and sensors, it can be used to prevent overcrowding of areas and guarantee safety. An important factor that should be taken into account is the assurance of privacy of people whose data is collected.

7. Conclusion

In this section the main question that was central in this research is answered. This answer is formulated based on the information that has been discussed in the results section. The research question that was central in this research is:

What role can the Internet of Things play in managing overtourism in the city of Amsterdam?

The role that the Internet of Things can play in managing overtourism in Amsterdam is substantial and the possibilities are extensive. The Internet of Things is mainly concerned with data. In managing overtourism in Amsterdam, the Internet of Things play an important role in the collection, and supply of data. As the amount of things that are connected with the internet grows, the amount of data that can be collected also grows.

With the information on tourist behaviour, it is possible for the municipality of Amsterdam to develop strategies, but also impose measures. If these strategies and measures make use of the strategies that have been offered by the WTTC to solve overtourism, the problem of overtourism can potentially be better managed. A good example of this is the "Visit Amsterdam, See Holland" strategy. This strategy is aimed at changing the distribution of tourists over space and in time, to take pressure off busy locations. With the use of data that is collected by the Internet of Things, strategies like these, but also measures such as ticket management and security monitoring can be supported. The discussed strategies and measures can be both implemented on a local level, as on a regional level, like in the MRA. This is the first role that the Internet of Things can play in managing overtourism, the role of data collected.

The second role that the Internet of Things can play is the one of information supplier. In this role, the Internet of Things is used as a tool to provide services and advices in real-time. With these services and advices, the behaviour of tourists can be influenced. It can for instance be used to influence a tourist so that he goes to tourist attraction 'A' where it is not that busy, instead of attraction 'B', where it is busy. By applying this strategy, local overtourism can be managed. This this mainly relevant on city-scale, as it happens in real-time.

With the realization of the Internet of Things, and an integration of a system where the Internet of Things is used to support the strategies offered by the WTTC, the balance in tourism can potentially be restored. This will support tourism to happen in a sustainable way, enabling sustainable tourism to be accomplished. This will lead to an increase of the quality of life of residents and an increase in quality of experience for tourists.

It can thus be argued that the Internet of Things can play a substantial role in the managing of overtourism in Amsterdam. In their strategic agenda 'Tourism in the MRA 2025', Amsterdam acknowledges the existence of the Internet of Things, and insinuates that it could possible become important in tourism. Whether or not Amsterdam will actively focus on the use of the Internet of Things will be interesting.

Discussion further research

Based on the results of this research can it be concluded that the Internet of Things can play a substantial role in manging overtourism in Amsterdam. Yet, how exactly the opportunities that come with the realization of the Internet of Things can be implemented and how achievable they are is still vague. This therefore asks for further research. It is therefore important that the opinions of the tourists themselves are well researched. Another interesting aspect for the research is the involvement and participation of tourist oriented businesses, as they can possibly also play a role in helping the management of overtourism in the city of Amsterdam.

Reflection

This aim of this research was to gain a further understanding of the role that the Internet of Things can play in managing overtourism in the city of Amsterdam. Based on the academic literature, strategic agendas, and policy documents it became clear that the potential of the Internet of Things is very broad. The findings from these documents were then used to develop a survey questionnaire in order to gain a further understanding of international tourist behaviour in Amsterdam. The collected data proved to be of valuable contribution to gain a further understanding of the research subject. In hindsight was the questionnaire too extensive. This caused the data collection process to be more difficult and meant some of the collected data proved not to be relevant to the research. In short can the result of this research be considered to be relevant, interesting and possibly valuable to the city of Amsterdam.

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9. Appendices

Appendix A

Survey Questionnaire Tourism in Amsterdam

Q1 What is your gender?

- ○ Male
- ○ Female
- ○ Other

Q2 What is your age?

_____

Q3 What country are you from?

_____

Q4 With who are you travelling?

- ○ Family
- ○ Partner
- ○ Friend(s)
- ○ Alone
- ○ Other, _____

Q5 Have you visited the Netherlands before?

- ○ Yes
- ○ No

Q6 How long is your stay in Amsterdam?

_____

Q7 Would you be interested in visiting other cities in the Netherlands while you are in the Netherlands, and why?

- ○ Yes because, _____
- ○ No because, _____

Q8 Did you bring any digital devices with you?

- ○ Yes
- ○ No

Q9 If no, why did you not bring a digital device?

_____

Q10 What do you use the device(s) for?

- [ ] Taking photos
- [ ] Searching for attractions
- [ ] Searching for destinations
- [ ] Route planner
- [ ] Communication
- [ ] Entertainment
- [ ] No devices were brought
- [ ] Other, _____

Q11 Are these devices connected to the internet?

- ○ Yes
- ○ No
- ○ No devices were brought

Q12 Why are your devices not connected to the internet?

- ○ No mobile service
- ○ No mobile service in the Netherlands
- ○ No WiFi
- ○ Devices cannot connect to the internet
- ○ No devices were brought
- ○ Other, _____

Q13 Are your devices connected to locational services?

- ○ Yes
- ○ No

Q14 Why are your devices not connected to location services?

- ○ My device cannot connect to location services
- ○ I do not feel comfortable using location services
- ○ No devices were brought
- ○ Other, _____

Q15 Would you be interested in a service provided by the municipality of Amsterdam that shows you which tourist attractions are busy and which are not?

- ○ Extremely interested
- ○ Very interested
- ○ Moderately interested
- ○ Slightly interested
- ○ Not interested at all

Q16 Please explain the answer on the previous question

_____

Q17 Would you be interested in a service provided by the municipality of Amsterdam that shows what route to the destinations you want to visit you can take best?

- ○ Extremely interested
- ○ Very interested
- ○ Moderately interested
- ○ Slightly interested
- ○ Not interested at all

Q18 Can you explain the answer on the previous question?

_____

Q19 Would you also be interested in the suggested services if these require you to be connected to the internet and location services and why?

_____

Q20 Would you be willing to share some personal information (age, health issues, location, etc.) with the municipality of Amsterdam if this helps them guarantee your safety?

- ○ Yes because, _____
- ○ No because, _____

Q21 Would you be willing to share some personal information (age, touristic preferences, location, etc.) with the municipality of Amsterdam if this helps them to improve your touristic experience?

- ○ Yes because, _____
- ○ No because, _____

Appendix B

One-sample T-test

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
How long is your stay in Amsterdam?	70	3,60	2,440	0,292

One-Sample Test						
	Test Value = 3.9					
	t	df	Sig. (2-tailed)	Mean Difference	90% Confidence Interval of the Difference	
					Lower	Upper
How long is your stay in Amsterdam?	-1,029	69	0,307	-0,300	-0,79	0,19

Crosstabuation Chi-Square test

Selected Choice Crosstabulation					
			Would you be interested in visiting other cities in the Netherlands while you are in the Netherlands?		
			Yes	No	Total
Have you visited the Netherlands before?	Yes	Count	17	4	21
		Expected Count	15,6	5,4	21,0
	No	Count	35	14	49
		Expected Count	36,4	12,6	49,0
Total		Count	52	18	70
		Expected Count	52,0	18,0	70,0

Chi-Square Test					
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	,698[a]	1	0,403		