

Smart.
Tourism



SMART Tourism Tools:

Linking technology with the touristic resources of city destinations

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NHTV Breda University of
Applied Sciences

SMART Tourism Tools

Linking Technology with the Touristic Resources of City Destinations

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"I hereby declare that this thesis is wholly the work of Richard Smith. Any other contributors or sources have either been referenced in the prescribed manner or are listed in the acknowledgements together with the nature and scope of their contribution."



Preface

This thesis has been written as part of my graduation at the NHTV, Breda. Conducting this research was highly interesting yet a challenging opportunity to broaden my knowledge on the subject of technology in tourism, specifically SMART Tourism Tools. My interest led me to this area after having completed a combination of marketing and communication courses during my specialisation in *Business Communication*. Furthermore, my internship was conducted in Malaga, a thriving Smart City with many new innovative concepts implemented for residents and visitors. Due to the global phenomena and rapid evolution of mobile technology, this thesis has been designed to be applicable anywhere to aid tourism professionals to make informed decisions.

The realisation of the contained thesis would not have been possible without the help of my supervisor, Wesley Put. I gratefully thank her for a critical eye, excellent support and enthusiastic supervision.

Finally, I would like to thank all those who participated in the interviews. Your knowledge and expertise's provided great insight into this much unknown subject.

Richard Smith

Breda, May 2015



Executive Summary

The rapid increase of the urban population has triggered complex challenges for cities around the world. City infrastructures are facing massive pressure as a result of more than half of the world's population residing in cities. Therefore, it has been crucial for cities around the globe to think in a future orientated way in order to be prepared for challenges caused by globalisation, urbanisation, climate-change, socio-demographic changes, new values and norms in societies. The concept **SMART City** has been developed. These SMART cities implement **Information and Communication Technologies (ICT)** to enhance quality of life, efficiency of mobility, economy and sustainability.

The new age of *ICT* has opened up an ample array of new tools for tourism. A simpler way to refer to these tourism specific *ICT* tools within **SMART Tourism Destinations** is under the name **SMART Tourism Tools** and they are fast becoming major key instruments in the tourism industry on-site at urban touristic destinations. Furthermore, these **SMART Tourism Tools** tend to predominantly exist within more technologically advanced destinations (SMART cities) where they can function effectively. Examples of these **SMART Tourism Tools** which are researched within the scope of this thesis are: Mobile **Applications**, **Augmented Reality & Near-Field Communication (NFC)** which have been explored in great depth within.

Tourism managers have none or little expertise of this subject and therefore the aim of this thesis is to provide the necessary knowledge for tourism managers in order to make SMART strategic decisions in regarding how use and implement touristic technology within destinations.

It is proposed that SMART tourism tools are a plausible solution to the many problems facing urban destinations and the tourists who visit them.

Therefore, the main objective of this thesis has been defined as follows:

To understand the concept of SMART Tourism Tools within destinations and enable tourism managers to make SMART decisions when implementing technology into their touristic resources.

The research has to the creation of a conceptual framework that is designed to visualize the deep and complex concepts raised in this thesis.

The main research goal for this thesis has been defined as follows:

How can destinations make the link between SMART Tourism Tools and Touristic resources in order for tourism managers to make SMART strategic decisions?

The specific research questions have been categorised in the following:

SMART concept

- What is the origin of the SMART concept?
- What infrastructure at the destination is required for SMART Tourism to function?

SMART Tourism destination

- What defines a SMART tourism destination?
- What is the profile of known users of these Smart tools?



SMART Tourism Tools

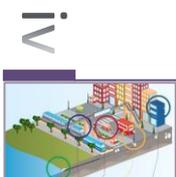
- What are SMART Tourism Tools?
 - What examples of *SMART Tourism Tools* are available? (In use/trialed)
 - How do these tools function and what are the benefits?
 - How do tools align with the touristic resources of a city?
- What are the current SMART Tourism Tools and how do they position with the touristic resources of a Smart destination? (Focusing on: Mobile Applications, Augmented Reality & Near Field Communication)
- What are the most appropriate *SMART Tourism Tools* to implement into a *SMART tourism destination*?

The research is based on several theories and models, with the main two notably models being the “6 A’s of tourism destination” (Attractions, Accessibility, Amenities, Available Packages, Activities and Ancillary Services) by Buhalis and the “Multifunctional character of Touristic Cities” by Badita. Both have been utilised in the creation of a conceptual framework to visualize the links between touristic resources and SMART Tourism Tools. However, due to the newness of the subject, the overall detailing and conclusion to this thesis is unique. Numerous leading experts have been reviewed in literature and verbally contacted from many different fields in order to gather findings under the single umbrella of SMART Tourism Tools. The interrelated complexity of the subject is detailed throughout and the first steps of a new conceptual framework are presented: “The Interrelated Triangle of SMART Tourism Tools”.

For this report, a mixture of secondary and primary research methods have been conducted. For secondary, in addition to academic articles, books and technology websites being reviewed, the current state of Applications, Augmented Reality and NFC technology usage in tourism businesses is also investigated by reviewing numerous examples from tourism organisations, universities and companies. This study provides managers a review of earlier literature clarifying what has been researched with regard to the above stated SMART Tourism Tools and provides tourism managers ways to implement these technologies in their destination. Therefore, this thesis is designed to act as a guide for tourism managers to better understand the SMART Tourism Tools available and where they can align with the touristic resources of their destination.

For primary, qualitative research was conducted in the form of semi-structured interviews. Leading educators, PHD researchers, students and industry professionals were sought from various relevant backgrounds in order to attain the objectives. This method is justified based on the freshness of the subject and personal communication were required to navigate the new concept of SMART Tourism Tools. Interviews were conducted via the means of face to face, telephone and Skype calls which enabled an international perspective through speaking with people in multiple distant locations.

Findings were analysed through coding methods (Grounded Theory) to establish re-current themes. Furthermore, direct quotes are frequently presented as they provide instant guidance and



recommendations for tourism managers seeking new insights. The outcomes of the literature reviewed and the semi-structured interviews have provided the information necessary for drawing conclusions and making suggestions for tourism managers interested in technology in tourism.

Based on the findings the following conclusions and recommendations were formulated:

It can be concluded that, the most positive way in which destinations can implement the right SMART Tourism Tools with their touristic resources is to always ensure that the **tourist experience is enhanced** with the introduction of any new ICT services. In this, it has been concluded that the following themes taken into consideration can achieve this objective: *Seamless Connectivity, Sharing Economy, Financial, Visual Content, Language, Privacy and Wearables*. Furthermore, the presented framework offers a new visual insight into the link between SMART Tourism Tools and the Touristic resources available at city destinations.

Therefore, the following recommendations are given:

For tourism managers:

- Soft SMARTness, Collaboration, Innovation and Leadership, is just as important as Hard SMARTness, technology and embedded environments.
- Invest in systems that have the ability to collect BIG Data, i.e. SMART Tourism Tools and infrastructure. Data leads to informed SMART decisions.
- Co-Create: technologies lead to better communication between all stakeholders, allowing destinations to interact with tourists and residents enable persons to be a part of the products. Thus, leading to enhanced experiences.
- Do not force technologies onto tourist: technologies should be seamless where interaction with SMART Tourism Tools is not complicated and value is guaranteed.
- Focus on enhancing tourism experience: focusing on the benefits for the tourists can lead to being a desirable destination. In doing so, it will lead to becoming a competitive destination globally and thus benefit itself in financial ROI.
- Utilise in 3rd party platforms rather than creating technological platforms (SMART Tourism Tools) independently which is costly, slow, complex and difficult to maintain. Moreover, international platforms like Facebook and booking.com should be utilised with the destinations own content and thus not go into competition to create their own social and booking platforms for a destination when these platforms are already strong brands.
- Rejuvenate Cultural Heritage sites with SMART Tourism Tools that enable storytelling and inspirational experiences. Digital education through entertainment and technology.
- Recognise growing trends in wearable technology and how this could be utilised into the tourism experience. APPLE Inc. is driving the way for convenient moneyless payment systems, it is arguable that this will transpire into admittance for attractions in the near present.
- Assure Privacy: ensuring users that data is secure will improve the acceptance of such technologies by persons and thus their successful adoption by tourists.
- Provide free Wi-Fi within infrastructure and/or SMART Tourism Tools that can be used offline in order to save on Tourist roaming charges. Tourists seek convenience of these services and thus enhance their short time on location. In return, destinations are able to track their visitors and gain new understandings of what is occurring at the destination.



For future researchers a detailed list of recommendations can be found within.

Finally, the author would like to emphasise that this thesis can be used as a practical guide to managing and implementing considerations of SMART Tourism Tools. It combines scientific research with practical insights that integrate the diverse and complex nature of tourism technology. The overall contents provide concrete guidelines and a better understanding of the fundamental principles involved in this subject. In doing so, this paper is aimed at Tourism Managers and other stakeholders from the public and private sector which are involved in urban tourism destinations.

Keywords: *SMART City, SMART Tourism Destination, Internet of Things (IoT), SMART Tourism Tools, Information and Communication Technologies (ICT), Application/s (APP/s), Augmented Reality (AR), Near Field Communication (NFC)*

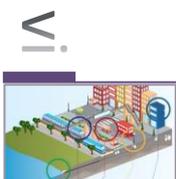


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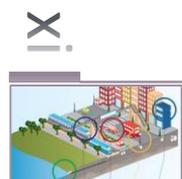


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List of Abbreviations

APP(s)	Application(s)
AR	Augmented Reality
GPS	Global Positioning Systems
ICT	Information, Communication & Technology
IoT	Internet of Things
NFC	Near Field Communication
P.C.	Personal Communication
POI	Point of Interest
RFID	Radio Frequency Identification Technology
STD	SMART Tourism Destination
STT	SMART Tourism Tool



1. Introduction

1.1. *Background*

The rapid increase of the urban population has triggered complex challenges for cities around the world. City infrastructures are facing massive pressure as a result of more than half of the world's population residing in cities (Falconer & Mitchell, 2012). Therefore, it has been crucial for cities around the globe to think in a future orientated way in order to be prepared for challenges caused by globalisation, urbanisation, climate-change, socio-demographic changes, new values and norms in societies. The concept **SMART City** has been developed. These SMART cities implement **Information and Communication Technologies (ICT)** to enhance quality of life, efficiency of mobility, economy and sustainability (Ronay & Egger, 2013a).

Buhalis & Amarangga (2013) bring these developments into a tourism context by stating "The new era of ICT has also opened a wealth of new tools for the tourism industry". A simpler way to refer to these tourism specific ICT tools within **SMART Tourism Destinations** is under the name **SMART Tourism Tools** and they are fast becoming major key instruments in the tourism industry onsite at urban tourist destinations. Furthermore, as previously mentioned these **SMART Tourism Tools** tend to predominantly exist within more technologically advanced destinations (SMART cities). Examples of these **SMART Tourism Tools** are: Audio City guide applications, Near-Field Communication (NFC) information tags, SMART cards, etc... These terms will be clarified shortly.

In order for SMART cities to function effectively, the main principle underlying the whole connectivity of the system is known as the **Internet of Things (IoT)**. Kevin Ashton (MIT) in 1999 defined "IoT as a network that can connect anything at anytime and anyplace in order to identify, locate, manage and monitor SMART objects" (Mingjun et al. 2012 as cited in Buhalis et al 2013), in this case SMART tourism tools connecting to the city via the internet. The notion behind the IoT is to produce automatic real-time interactions between real world objects that connect to the Internet which consequently also reduce the gap between real world and digital realm (Erb, 2011 as cited in Buhalis et al 2013). For example: gaining information on bus arrival times based on GPS on the bus that is able to upload its location to a control centre in the city via the internet, this information would then be accessible to the commuter through an application within their personal mobile SMART device. This sharing of data is reliant on connection with the internet.

Buhalis & Amarangga (2013) go one step further to formulate the following definition based on combining the above aspects of **SMART City**, **ICT tools**, **IoT** and **Tourism**. In doing so, they define these locations as **SMART Tourism Destinations**. The aim of this concept is to enhance tourism experience and maximise destination competitiveness, moreover, increase consumer satisfaction whilst applying sustainable techniques (Buhalis & Amarangga, 2013).

From a tourist perspective, *SMART Tourism Destinations* that use integrated *SMART Tourism Tools* can contribute in enhancing the value-added experiences for tourists, while also improving efficiency and supporting process automation for the related organisations (Werthner, 2003 as cited in Buhalis et al, 2013).

SMART Tourism Destinations can take good advantage of a fully integrated tourism market, tourist attractions, government departments and relevant information and services of enterprises to promote the development of tourism. (Su, Li, & Fu, 2011). Additionally, SMART cities have the potential to attract investors and create significant economic benefits through developing strong infrastructure (GSMA 2013 as cited in (Ronay & Egger, 2013b).

Therefore, a *SMART Tourism Destination* that incorporates *SMART Tourism Tools* is able to provide better services and offer the opportunity to enhance the experience of tourists (Neuhofer, Buhalis, & Ladkin, 2012). In turn, there can be economic rewards through investments, promotion and the saving of unnecessary costs. This is achieved through obtaining real-time data and understanding the city needs better. Though it must be mentioned that these technologies can be seen as a ‘threat to privacy’ by some users (Buhalis & Amarangga, 2013). This is due to transfer of personal information and location based services which can track an individual’s movement at a destination. However, not a concern for all tourists which will be discussed later in the literature review. At this time, there appears to be little further recorded on the negative aspects of implementing *SMART Tourism Tools* to a destination. Therefore, primary research is required to explore these tools further, this thesis will seek to achieve this.

The problem, which this research will focus upon, is that with the wide variety of *SMART Tourism Tools* available to a *SMART Tourism Destination*, it can be difficult for the stakeholders to choose the appropriate *SMART Tourism Tools* to implement to meet the needs of the tourists at that destination, situation or occasion. Therefore, this study will analyse the current relevant *SMART Tourism Tools* in use and any future SMART tools that have been well-documented in trials. Furthermore, due to the broad context of ICT in tourism, this thesis primarily focuses upon mobile applications (APPs), Augmented Reality (AR) and Near Field Communication (NFC). Additionally, In order to attain a global perspective of *SMART Tourism Tools*, this thesis will conduct a strong focus secondary research combined with semi-structured interviews with professionals and experts in the field.

In conclusion, the aim of this research is to bring forth the SMART Tourism Tool concept and a deeper understanding of its meaning. Furthermore, to create a conceptual framework in which *SMART Destinations* can easily view and decide on what are the appropriate *SMART Tourism Tools* (APPs/AR/NFC) to implement into the destination that will meet the demands of its market and city touristic resources.

The benefits of this framework will be that it can inform *SMART tourism destinations* what are the recommended and appropriate *SMART tourism tools* applicable to the different aspects of a tourism

destination. Thus, this framework will clarify to which resources the *SMART tourism tools* are applicable. Concluding that this research has the potential to aid tourism developers of a destination to improve and/or create new tourism products that can strengthen its competitiveness in the tourism world. Buhalis & Amaranggana (2013, pg. 554) re-affirm this by stating “with technology being embedded within the destinations environment, it can enrich tourist experiences and enhance destinations competitiveness”.

The included literature review provides a deeper insight into the background and current uses of these tourism technologies. Furthermore, the extent of how much they have already integrated globally into modern day life will be highlighted, and in some cases possibly surprise the reader the degree of this. Additionally, urban touristic resources will be discussed.

However, the following will offer the reader a brief insight into user characteristics and to why the exploration in to SMART Tourism Tools is relevant into the needs of the modern tourist. In this, Generation Y: the new NET Generation is critiqued as they display the strongest link between technology and user.

Generation Y (born 1977-1997) are recognised to be completely different from earlier generations, the influencing factor being technology, “to the point that life is lived through a screen” (Yeoman & Yu, 2012). Tapscott (2009 as cited in Yeomans et al. 2012) referred to this generation as the ‘*Net Generation*’ because technology has advanced at a rapid rate during their era. The *Net Generation* did not have to accommodate to new forms of technology unlike the baby boomer generation. Instead they adapted easily and without difficulty to the new and advanced technologies. This new generation is driving the innovation and developments of technologies and revolutionising the meaning and use of the internet (Yeoman & Yu, 2012). “The Net Generation’s high assimilation to technology is reflected from their ability to multi-task, such as talking to friends, listening to music and surfing multiple websites all at the same time” (Yeoman & Yu, 2012, p. 77). “Tapscott (2009) had also identified that this generation do not observe, but rather participate in online activities. Unlike previous generations of passive internet users, the *Net Generation* uses the internet to inquire, discuss, argue, play, shop, critique, investigate, ridicule, fantasize, seek and inform” (Tapscott, 2009, p. 40 as sited in Yeoman & Yu, 2012, p. 77) which is what is fuelling the demand of interactive experiences, i.e. in apps, mobile entertainment, etc..

The *Net Generation* likes to share information and stay connected with close circles, they use technology such as from mobile phones to social networks to achieve this (Yeoman & Yu, 2012). “The advancement in mobile technologies, such as mobile internet, means that mobile phones are no longer perceived as just communication devices, but rather a vital connection to their social networks, enabling them to stay connected online wherever they go. Smartphones such as iPhone and Blackberry are mobile phones that have access to general internet and support user applications” (Yeoman & Yu, 2012, p. 78). In terms of tourism, this is highly relevant for destinations to be able to communicate to their visitors on-site via the tourist’s personal device.

The Australian Interactive Media Industry Association determined that 77% of surveyed respondents use their mobile phones for other reasons than calls or SMS, 56% said they use it to search for information and 21% use it to visit a website at least once a day (AIMIA, 2009 as cited in Yeoman & Yu, 2012), thus reflecting the evolving role mobile devices play. Yeoman & Yu (2012) also argue that, users are increasingly integrating smartphones into their daily lives, replacing computers and using it to surf the internet, using it as a *GPS* guide during trips, meaning that this important significates to travelling and tourism usage.

Through being aware of the current trends in markets, destination stakeholders can be in better position to anticipate the needs and demands of tourists. In essence, to make better decisions. A deeper look into the characteristics of these users will be reviewed shortly.

1.2. Research Objective & Questions

The Following will now outline the research goal of this thesis and place into context the necessary questions to be asked.

Research objective

To understand the concept of SMART Tourism Tools within destinations and enable tourism managers to make SMART decisions when implementing technology into their touristic resources.

The research will lead to the creation of a conceptual framework that will be designed to visualize the deep and complex concepts raised in this thesis.

Main Research goal and questions categorised:

How can destinations make the link between SMART Tourism Tools and Touristic resources in order for tourism managers to make SMART strategic decisions?

SMART concept

- What is the origin of the SMART concept?
- What infrastructure at the destination is required for SMART Tourism Tools to function?

SMART Tourism destination

- What defines a SMART tourism destination?
- What is the profile of known users of these Smart tools?

SMART Tourism Tools

- What are SMART Tourism Tools?
 - What examples of *SMART Tourism Tools* are available? (In use/trialled)
 - How do these tools function and what are the benefits?
 - How do tools align with the touristic resources of a city?
- What are the current SMART Tourism Tools and how do they position with the touristic resources of a Smart destination? (Focusing on: Mobile Applications, Augmented Reality & Near Field Communication)
- What are the most appropriate *SMART Tourism Tools* to implement into a *SMART tourism destination*?

1.3. What can be done with the outcome / results?

This research will seek to produce an insight into SMART Tourism Tools currently available. Furthermore, it is the point of this study to highlight where those tools can be used within a SMART tourism destination through the creation of a conceptual framework. It is hoped that in producing this resource that destination stakeholders, predominately focusing on aiding municipality departments, will be able to choose the

appropriate SMART Tourism Tools applicable to their destination. In doing so, they can effectively create or enhance current tourism products that can meet the needs of their visitors/tourists.

1.4. Methodology brief

The research for this thesis consists of a combination of secondary and primary methods. An initial extensive literature review has been conducted to gain a full overview of this new subject. After this, a period of semi-structured interviews have been sort with leading educators, researchers, professionals and industry leaders. Due to the broadness of the research problem, different fields and expertise have been combined in order to reach the thesis goal. *Details about the methodology can be found in Chapter 3.*

1.4.1. Research approach

It can be stated, it will be difficult for the researcher to find *SMART Tourism Tools* in clustered in any one region. This is simply due to the fact that these technologies are still very new and are spread much across the globe, moreover, some of these tools may have only been documented in successful trials. Therefore, this study will collect information from various destinations from around the globe via a strong secondary focus (well-documented trials in scientific studies). It is believed that this will lead to a small catalogue of knowledge on the tools in order to then align them with the touristic resources of a city. As the researcher is positioned within the Netherlands region during the research, an international perspective has been gained through interviews conducted with persons outside of the Netherlands.

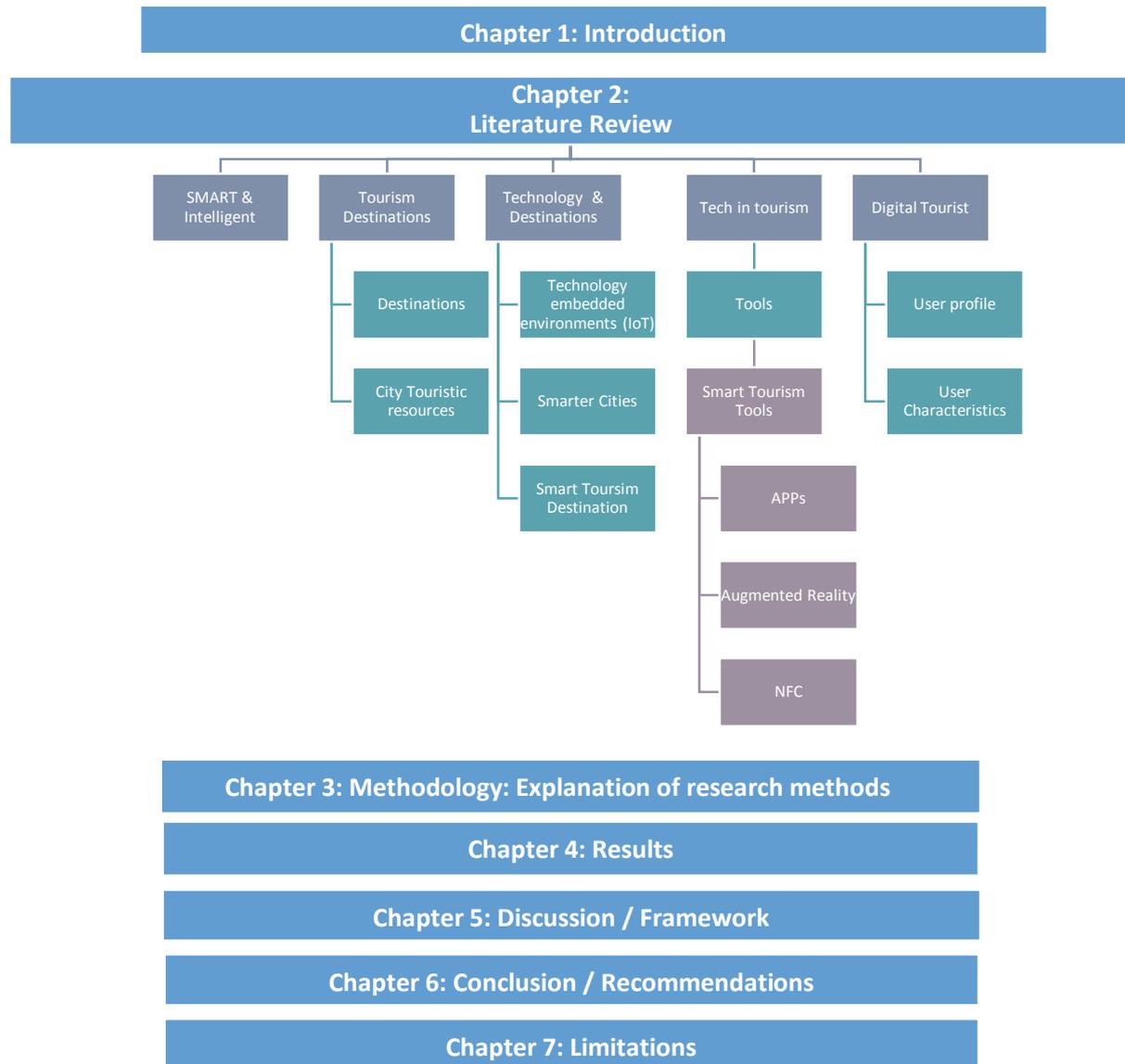
1.4.2. Research Scope

The broad scope of the research has been necessary in order to reach the thesis goal. This has been an essential requirement due to the newness of the subject and a necessity to lay the foundations for the unknown concept of SMART Tourism Tools. Thus, future research on this subject could be supported by this work and reduce the need to define key terms outlined within. Moreover, due to the high context of information throughout, extra and deeper steps have been taken to lay down fundamental background topics in order for the reader to fully appreciate and understand the complex subject of SMART Tourism Tools.

1.5. Structure of report

This report consists of 6 chapters. Chapter 2 focuses on relevant literature, concepts and important terms such as SMART, tourism destinations and tools (Applications, Augmented Reality & NFC). The literature functions as crucial foundation for the Thesis, and thus, an extensive insight has been put forward to enable the reader to follow these extremely new concepts and why they exist. Chapter 3 outlines research methods, techniques and justification to chosen means. Chapter 4 discusses findings of the research. In Chapter 5, overall summaries are presented and the conceptual framework is explained. In the final chapter of this thesis, Chapter 6 concludes on research questions and recommendations on the utilisation of framework and advised further research areas. *The following page visualises the schematic overview of this thesis.*

1.5.1. The schematic overview of this thesis is as follows:



2. Literature review

The world is facing rapid and intense changes. Approximately half of the world's population currently live in cities and urbanisation continues to show constant growth (Krawczyk & Ratcliffe, 2005). It is believed that by 2050 almost nine billion people will live on earth, of which 70 percent will reside in cities (Ronay & Egger, 2013a). Therefore, it is important for destinations around the world to think in a "future orientated way [...], in order to be prepared for challenges caused by globalisation, urbanisation, climate change, socio-demographic changes, new values and norms in societies" (Ronay & Egger, 2013a). Cities therefore are very important for the tourism industry and thus this literature review analyses the aspects of *SMART destinations* and tourism. In addition, this literature review will address many technical concepts including *Internet of Things*, *SMART Tourism Destinations* and *SMART Tourism Tools (specifically; tourism related Applications, Augmented Reality and Near Field Communication)*. Firstly, it is essential to outline definitions of SMARTness, tourism destinations and the touristic resources in order to fully appreciate the latter parts in context to meet the needs of the defined goal.

2.1. *SMART vs Intelligent*

Due to the core of this thesis, it is appropriate at this stage to clarify the following definitions as they will be frequently referred to.

'SMART and 'Intelligent' have been universally applied in much of today's theory and practice. Smart technology, which suggests intelligent aspects, "commonly describes a new product, referring to the environment, condition or motion of technology that adapts to certain functions or is tailored to specific circumstances" (Worden et al. 2003 as cited in Neuhofer, Buhalis, & Ladkin, 2015, p. 2). Whereas, intelligent systems have been defined as "systems with the two-fold ability to sense the environment and learn actions to achieve particular goals. In the context of tourism, intelligent systems have been framed as autonomous systems that anticipate user needs and encompass comprehensive and specific knowledge adaptable to consumer input" (Gretzel 2011, as cited in (Neuhofer et al., 2015, p. 2).

2.2. Defining the Tourism Destination

This section of the literature reviews offers insight into the clarification of the Tourism Destination in context and Touristic resources within an urban destination. In doing so, latter parts of the review will be supported by these fundamental foundations.

2.2.1. *Tourism Destinations*

There are many perspectives for defining the *Tourism Destination*. In a geographical way, Buhalis & Amaranggana (2013, pp. 556) defines tourism destination as "an area that selected by visitors which encompasses all necessary amenities such as accommodation, restaurant and entertainment".

Whereas United Nations defines it from a tourist motivation viewpoint stating “the meanings of destination are lies under tourists’ perception of a place that motivates them to take the trip (Lamsfus and Alzua-Sorzabal 2013 as cited in Buhalis & Amaranggana, 2013, pp. 556). Moreover, Buhalis, (2000, p. 97) refers to destinations as “amalgams of tourism products” and “services which exclusively produced and offer to the potential customer as an integrated experience” (Buhalis & Amaranggana, 2013, pp. 556) .

Buhalis (2000, as cited in Buhalis et al, 2013) argues that successful destinations are structured as containing the “6As of tourism destinations”, which are:

1. *Attractions: natural like a mountain, artificial like an amusement park, and/or cultural like a music festival.*
 2. *Accessibility: entire transportation system within a destination comprising of available routes, terminals and public transportation.*
 3. *Amenities: all services facilitating a stay, notably accommodation, catering and leisure/touristic activities.*
 4. *Available Packages: “the availability of service bundles by intermediaries to direct tourists’ attention to certain unique features of a respective destination”.*
 5. *Activities: available activities at the destination which primarily motivate tourists to visit the destination, and lastly...*
 6. *Ancillary Services: services to which are secondary to tourist needs like banks, postal services, hospitals, etc...*
- (Sourced from the 6As framework by Buhalis 2000, pp. 98).*

Buhalis & Amaranggana (2013) go further by stating that it is important for destinations to maintain each of their 6As to remain highly competitive. However, considering that consumers are now more than ever involved in the co-creation process, destinations must also realise that “they need to interconnect all their stakeholders to facilitate a dynamic co-creation process to increase destination competitiveness” (Neuhofer et al. 2012, as cited in Buhalis & Amaranggana, 2013, pp. 557). Here lies the opportunity for destinations to evolve through technology.

2.2.2. Defining Urban Touristic resources of cities

As earlier stated and leading on from the aspects of the 6 A’s of a tourism destination, the aim of the research is to understand where *SMART Tourism Tools* can align with an urban destination’s resources, i.e. attraction, amenities, etc... within a touristic city. Therefore, referring to Badita’s (2013) work, she applies a modified version of Burtenshaw et al. (1991) model that highlights the multifunctional character of touristic cities. The following framework is very interesting as it brings forward the many aspects of a tourism city. In doing so, it can bring potential to fill in the gap of where SMART Tourism Tool are positioned within the many dimensions of a ‘*Touristic City*’. In addition, the framework also links the type of user demand with the available resources of a tourist city which could also provide further SMART Tourism Tool understanding to user needs of services.

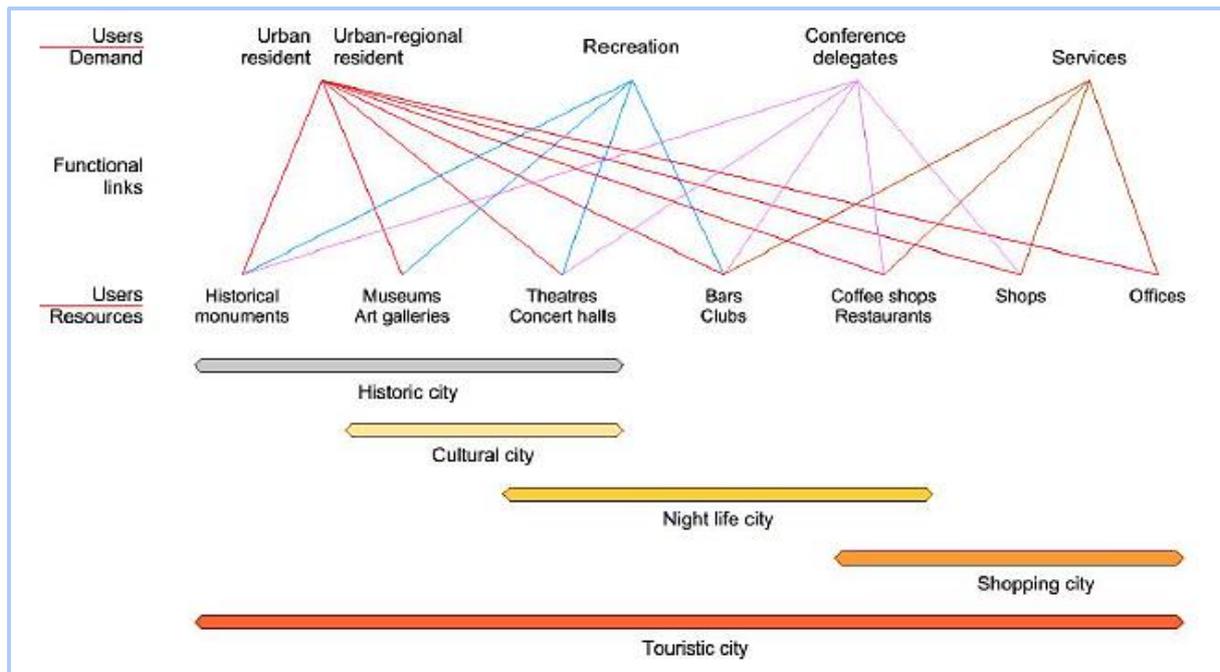


Figure 1 - the functional links between the demand and supply in a touristic city. Source: Badita (2013).

Figure 1 (above) shows that cities have a multifunctional character that determine a complex typology of visitors. These visitors have a high demand and use different resources in the city (BĂDITĂ, 2013). “According to the theory of ‘overlapping cities’ the tourist city is of several types which have different urban resources, such as: the historic city (with historical monuments, museums, art galleries, theatres and concert halls), the cultural city (with museums, theatres), the nightlife city (bars, clubs, cafes, restaurants), the shopping city (shops, cafes, restaurants) and the polyvalent city that includes all the above mentioned elements” (Burtenshaw et al., 1991 as cited in BĂDITĂ, 2013, p. 60). Burtenshaw’s framework demonstrates for each of the urban resources there is a tourism demand and functional links are formed between the different types of tourism in the city; i.e. recreation, leisure, business, shopping, and the tourists.

This touristic city framework is an ideal platform for positioning SMART Tourism Tools within the diverse resources on offer at urban tourism destinations. Therefore, aspects of this framework will be utilised for the purpose of highlighting the wide spectrum of SMART Tourism Tool usability and touristic resources.

2.3. Technology & Destinations

In order to meet the goal of this thesis, it is now important to build on those previous resources mentioned and discuss technological aspects of modern cities in relation to tourism. The following aims to initially be very broad to understand the fundamentals of big concepts and how these ideas have led to new smaller initiatives within a tourism industry. In this, to demonstrate the origins and ability of why SMART Tourism Tools are able function effectively. Firstly, by explaining the necessary communication systems (Internet of Things) needed, the origins of the SMART planet idea and thus leading to its links with tourism.

2.3.1. Technology embedded environments: Internet of Things (IoT)

The basis for the *Internet of Things* concept mainly focuses on applying next-generation *ICT* to all possible areas of life, embedding sensors and equipment to hospitals, power grids, railways, bridges, tunnels, roads, buildings, water systems, and gas lines and other objects in every part of the world. Made possible because they can be all linked via the Internet. The *Internet of Things* is then integrated through super-computers and cloud computing (Su et al., 2011).

The term *IoT* was first put forward by Kevin Ashton, MIT, in 1999. The idea received considerable attention from governments, scientific research institutions and technology enterprises (Weber, 2010; Sarma, Brock and Ashton, 2000 as cited in Guo et al., 2014). However, it was the International Telecommunications Union who expanded *IoT* from the *radio frequency identification (RFID)* technology to a wider scale (Lu, Zhang, Yang and Ning, 2008; I. Lee and B. Lee, 2010; Ustundag, Kilin and Cevikcan, 2010 as cited in Guo et al., 2014). Ashton defined *IoT* as a network that can “connect anything in anytime and anyplace in order to identify, locate, manage and monitor SMART objects” (Mingjun et al. 2012 as cited in Buhalis et al., 2013, p.554). Furthermore, the notion of “IoT is to generate automatic real-time interactions among real world object that connect to the Internet which consequently also reduce the gap between real world and digital realm” (Erb 2011 as cited in Buhalis & Amaranggana, 2013, p. 554).

In Chen and Zhou’s study (2010 as cited in Guo et al., 2014) they proved that the *IoT* technology enhances tourism. In this, they stated that tourist destination selection, route planning, bookings, and management of tourist attractions can be included in the *IoT* information system. Thus, *IoT* could integrate all types of tourism resources and predominantly the information resources. Sharing information on resorts, hotels and transportation, for example, could provide extra support for customers (GUO, LIU, & CHAI, 2014). (Yeoman & Yu, 2012, p. 68) display an example of this in the connected city traffic cameras to the internet allowing users to track live traffic conditions, these transport systems are also linked to cloud computing that provide information directly to users. Although technologies are highly integrated into the *digital city concept*, it still requires a platform to send and collect data such as a mobile device (i.e. tablet, smartphone). Ideal as this is now generally the most common device that tourists will travel with while mobile. The internet has and is one of the biggest drivers of product design for mobile devices as they are heavily reliant on its mobile internet capabilities, in this, it has allowed connectivity to the internet for instant access to information (Yeoman & Yu, 2012). In terms of the tourist, this allows the user to gain and process information quickly while away from a fixed computer or while travelling in unfamiliar city.

The future of the *IoT* technology in *digital Tourism* development primarily includes: “intelligent hotel management system, scenic spot intelligent ticketing system, intelligent remote video monitoring system, intelligent tour guide system, and intelligent travel agency system” (Formica and Kothari, 2008; Gretzel, 2011 as cited in GUO et al., 2014, p. 58). Simply explained, these technologies will automatically function based on the ability to communicate efficiently in real-time wherever and whenever. Moreover, these

applications clearly show that there will be a high demand and need for knowledgeable consultants to advise destinations on appropriate *BEST* practice implementation methods in the future. The rise of the *SMART planet* concept and the promotion of *SMART cities* has enhanced the needed involvement of the *IoT* technology (GUO et al., 2014, p. 56).

2.3.2. Making cities Smarter: A new way of thinking

In November 2008, Samuel Palmisano, IBM's CEO, made a speech, explicitly putting forward the concept of *SMART planet* in the '*SMART Planet: Agenda of the Next-generation Leaders*'. In early 2009, Palmisano again put forward his concept of *SMART planet*, which received a positive response from President Obama. Later that year, during the 2009 IBM event, D.C. Chien, IBM CEO of China, announced *SMART planet* as the latest strategy for the company's future. During August 2009 the Premier Wen-Jiabao visited the institute of *Internet of Things (IoT)* in Wuxi China, he proposed that in the development of sensor networks, that the people of China needed a plan for the future and make breakthroughs in core technology early, to push China through the era of *Internet of Things* (Su et al., 2011). In this, people can then "manage production and life in a more meticulous and dynamic way, achieving the state of global intelligence, and ultimately reach: Internet + Internet of Things = *SMART planet* " (Su et al., 2011, p. 1028).

More recently, the concept *SMART planet* has been commonly referred to in its smaller scale projects, which are *SMART city*, *SMART grid* and *SMART enterprises*. They are defined as important parts of *SMART planet*. In short, *SMART city* is the actual approach of *SMART planet* applying to specific region, achieving the informational and integrated management of cities (Su et al., 2011).

SMART city is one of the most popular topics discussing the most cutting-edge issues and in recent years the construction of *SMART cities* has been spreading across the world, from London to Taipei and New York to Singapore, etc... (Su et al., 2011, p. 1028). *SMART cities* implement *Information and Communication Technologies (ICT)* to "enhance life quality, efficiency of mobility, economy and sustainability" (Ronay & Egger, 2013a). More specifically, IBM defined *SMART city* as the use of *ICT* "to sense, analyse and integrate the key information of core systems in running cities [...] at the same time, *SMART city* can make intelligent response to different kinds of needs, including daily livelihood, environmental protection, public safety and city services, industrial and commercial activities" (Su et al., 2011). Thus, a *SMART City* is a city that has made their system instrumented, interconnected and intelligent. Buhalis & Amaranggana (2013, page 555) add to this by stating "Within this definition, instrumentation denotes that city activities are measurable by sensors that scattered around the city; interconnection means that every bit of a city are connected through *ICT* network both wired and wireless; and intelligence refers to predictive applications that have the ability to generate more accurate decisions". Schaffers et al. (2011 as cited in (Ronay & Egger, 2013b) highlights the aim of *SMART Cities* is to develop *ICT* based services by incorporating user centric applications and future internet technologies, and to encourage researches focusing on the development of innovative applications and services.

The benefits of the *SMART city* concept is that with presence of a digital grid (*IoT*) connected to urban areas, resources, environment, economic, social and other systems, as well as the digital and informational processing and application of urban infrastructure and basic environment, it can be possible to achieve intelligent urban management of services, thus promote the more efficient and harmonious operation of modern cities (Su et al., 2011).

(Law, Buhalis, & Cobanoglu, 2014; Ronay & Egger, 2013b; Su et al., 2011) all agree that *SMART City* will be the future trend of urban development. Su et al. (2011) explains that “the construction” of *SMART city* is easily divided into three levels which are the “construction of public infrastructure, construction of public platform, and the construction of application systems” in this, *the construction of application systems* is of most importance. *SMART city* has been typically applied to various aspects and thus the following list shows these typical applications within a *SMART city* (Su et al., 2011). These are:

- construction of wireless city
- construction of *SMART home*
- construction of *SMART transport*
- construction of social management
- construction of *SMART urban management*
- construction of *SMART medical treatment*
- construction of green city
- **construction of *SMART Tourism***

Obviously, the latter, *SMART Tourism*, being of most interest to this research. However, it has been vital to clarify that the application of *SMART cities* is far broader than tourism alone. The following of this thesis is now dedicated to the tourism aspects to achieve the desired goal. Therefore, the application of *SMART tourism* innovations and services will be reviewed:

2.3.3. *SMART Tourism*

As established, the *SMART city* concept consists of many possible applications. Though, the following will now focus on the relevant tourism aspects. McCartney, Butler and Bennett (2008) agree that the *SMART Tourism City* is an important factor and practical effort of the *SMART city* strategy (GUO et al., 2014). Based on *cloud systems* and *IoT*, *SMART Tourism* applies intelligent perception of tourism information, like tourist resources, tourism economy, tourism activities, and tourism participants “to realise the acquisition and adjustment of real-time tourism information through mobile Internet equipment” (MacKay and Vogt, 2012; ChoandJang, 2008 as cited in GUO et al., 2014, pp. 56–57)

SMART Tourism is reliant on four core *information and communication technologies: IoT, mobile communication, cloud computing, and artificial intelligent technology* (GUO et al., 2014), which are all pre-existing in the *SMART city*. These technologies connect the physical, information, social, and commercial infrastructure of tourism, and supplies *SMART Tourism* value to multiple stakeholders of a destination

(GUO et al., 2014). Moreover, the development of SMART Cities also facilitates seamless access to value-added services for tourists of a city, like access to real-time information on public transportation (Buhalis & Amaranggana, 2013). The future direction of *SMART Tourism* is mainly reflected in intelligent: service, business, management, and governance (Yao, 2012 as cited in GUO et al., 2014, p. 59) which are important factors for destinations to consider. Furthermore, “based on the integration of hardware and software platform for information and services of SMART city, SMART tourism can be taken good advantage of to fully integrated tourism market, tourist attractions, government departments and relevant information and services of enterprises to promote the development of tourism” (Su et al., 2011, p. 1030). This brings forward the positive benefits destinations can enjoy through investment in knowledge and money on strengthening these technological products within the tourist area. So concluding on the previous, the developments within the *SMART City concept, ICT, IoT and Tourism* also encourages the formation of *SMART Tourism Destinations* (Buhalis & Amaranggana, 2013).

2.3.4. SMART Tourism Destinations

The travel and tourism industry has always been at the forefront of technology and has taken advantage of the link between technology and tourism (Buhalis & Law, 2008 as cited in Neuhofer, Buhalis, & Ladkin, 2012, p. 38). Therefore, Buhalis and Amaranggana (2013) bring forward the concept of *SMART Tourism Destinations* in which builds upon the principles already discussed.

In short, Buhalis & Amaranggana, (2013), state that *SMART Tourism Destinations* “take advantage of:

1. *Technology embedded environments;*
2. *Responsive processes at micro and macro levels;*
3. *End-user devices in multiple touch-points; and*
4. *Engaged stakeholders that use the platform dynamically as a neural system”.*

The overall aim is to enhance tourism experience, improve the efficiency of resource management and maximise destination competitiveness, moreover, increase consumer satisfaction whilst implementing sustainability aspects to the destination (Buhalis & Amaranggana, 2013, p. 557). This conceptualises upon what has already been discussed in this paper and forms the new understanding of SMART infrastructures as tourism destinations within these urban boundaries.

Once again and as already identified, Buhalis and Amaranggana (2013) re-affirms, in a *SMART* and tourism context, that there are three forms of *ICT* are vital to setting up a *SMART Tourism Destination; Cloud Computing, IoT and End-User Internet Service System*. The *Cloud Computing* services are designed to provide convenient way to access online data storage. “For example, a sophisticated tour guide system could serve massive number of tourists without being actually installed on any personal device (Zhang et al. 2012 as cited in Wang et al. 2013). Second, the *IoT* could support *SMART* destinations in terms of providing information and analysis as well as automation and control (Chui et al. 2010). For example, chips embedded to entrance ticket allow tourism service providers to track tourists’ locations and their consumption behaviour so that location-based advertising could be executed (Lin 2011). As for automation

and control, the system could control visitor numbers within specific tourism sites by using a variety of sensors in regard with each sites' carrying capacity (Mingjun et al. 2012). The third component of a SMART destination is the End-User Internet Service System, which refers to number of applications at various levels supported by combination of *Cloud Computing* and *IoT*. For example, Barcelona had established Project LIVE that concerning on the creation of innovative hub for electrical vehicles. LIVE's charging points map could be accessed remotely via Apple's iPhone and Google's Android to check all the availability status of vehicles' charging points (Jung 2011)" (Buhalis & Amaranggana, 2013, p. 558). These example place into context use of SMART technologies within tourism.

Lamsfus, Martín, Alzua-Sorzabal, & Torres-Manzanera (2015, p. 367) also add that "a Tourism Destination is said to be Smart when it makes intensive use of the technological infrastructure provided by the Smart City in order to:

1. *Enhance the tourism experience of visitors by personalizing and making them aware of both local and tourism services and products available to them at the destination, and*
2. *By empowering destination management organizations, local institutions and tourism companies to make their decisions and take actions based upon the data produced in within the destination, gathered, managed and processed by means of the technology infrastructure."*

The principles of *SMART Tourism Destination* is to enhance the tourist travel experience, provide more intelligent platform gather and distribute information within destinations, facilitate efficient allocation of tourism resources and to integrate tourism suppliers at both micro and macro level aiming to ensure that benefits from the sector are well distributed to local society (Rong 2012 as cited in Buhalis & Amaranggana, 2013, p. 562). This can be done through providing consumer valued services, these can be in the form of SMART services or *SMART Tourism Tools*.

2.4. Tech Tools in Tourism

This section of the review will seek to clarify what a SMART Tourism tool is by breaking the fundamental parts down. In this, just like referring to a guide book as a TOOL, it must be explored further to understand these new Digital tools available to tourism.

2.4.1. Tools

Anacleto, Figueiredo, Almeida, & Novais (2014, p. 56) state that "the tasks of planning where to go and what to do, in the limited amount of time available, are common problems encountered by tourists when visiting a city for the first time [...] In effect, cities are very large information spaces and in order to navigate through these spaces, visitors have available numerous guide books and maps that provide large amounts of information". Therefore, the authors argue that when a tourist goes to a new city, they benefit when they have a user-friendly *tool* to help plan, find preferences, gain knowledge, budget and use available time wisely (Anacleto et al., 2014).

To understand these so-called *Tools* better, it is wise to gain an insight into *Ubiquitous computing* which refers to technologies that “interact with humanity out in the open rather than users connecting with the computer; it is the interaction of one user with many interfaces through technology that is interwoven into the external environment” (Yeoman & Yu, 2012, p. 67). *Ubiquitous computing* allows integration of devices and technology to function, in a city where everything is enabled and shared via the *IoT*. (Yeoman & Yu, 2012, p. 68). Therefore, *Ubiquitous Computing* not only refers to mobile devices but also includes SMART card technology, i.e. travel and/or entrance electronic tickets.

Tussyadiah (2013), Wang, Park and Fesenmaier (2012, as cited in Tussyadiah, 2014) identified the important roles of personal technology, such as personal computers, tablets, and smartphones, in travel experiences (e.g., the power for enablement, facilitation and enhancement of experiences). The inclusion of technology in the tourism experience is conceptualised as technology mediation, which has the influence to assist tourists by providing or limiting access to certain experiences (Tussyadiah, Fesenmaier, & Yoo, 2008 as cited in Tussyadiah, 2014), this is also supported by Neuhofer et al. (2012). Moreover, New services, apps and products in safety, ecology, mobility, connectivity, retail and cultural (Chillión, 2014) have come to surface and fuel the catalogue of new *SMART Tourism Tools* available to the tourist.

As these tools are a part of *Ubiquitous Computing*, its relevant to state that *SMART Tourism Tools* are a part of the actual travel phase (on-site phase) at physical tourism destination (Neuhofer et al., 2012), in this case a touristic city. Obviously, the tourist is on the move and “the increased mobility has rendered mobile technologies key tools” (Egger & Jooss, 2010 as cited in Neuhofer et al., 2012), “as these enable information retrieval anywhere and anytime” (Balasubramanian, Peterson & Jarvenpaa, 2002 as cited in Neuhofer et al., 2012). Moreover, SMART tools that have location based services, instant access to information, content and/or recommendation sites relevant to the current location, can offer opportunities for the destination to “connect, assist, and engage with the tourist in the online environment on-site” (Green, 2002, as cited in Neuhofer et al., 2012, p. 41), which means that destinations that provide *SMART Tourism Tools* have the potential to influence the tourist experience for the better.

[2.4.2. SMART Tourism Tools](#)

“The new era of ICT has also opened a wealth of new tools for the tourism industry” (Buhalis & Amaranggana, 2013, p. 554). In this segment, the Term *SMART Tourism Tool* can be clarified that it has been formed on the basis of the concepts derived from: SMART + Tourism + Tools (ICT).

In a tourism context, tourists can simply use their mobile phones to explore the destination and events. Users enabled by technology in *SMART Tourism Tools* are able to navigate their way through urban environments without the use of maps or guidebooks – a trend that is pre-existing in Tokyo (Yeoman & Yu, 2012, p. 69). These activities leave sizeable amounts of digital data known as **Big Data** (SOCAP International, 2013 as cited in Buhalis & Amaranggana, 2013). Through managing *Big Data*, tourism organisations are in a position extract valuable insight from the information that could provide tourists

with a new dimension of customer experience and improve the way destinations interact with customers, “those who master this form of technology gain an abundant competitive advantage compare to competitors” (Buhalis & Amaranggana, 2013, p. 555). The development of software and hardware in mobile computing has supported a vast amount of applications, notably visual tagging of physical objects and *Near Field Communication (NFC)*, which has that contributed and complemented the development of the *IoT* (Borrego-Jaraba, Luque Ruiz, & Gómez-Nieto, 2011).

2.4.2.1. *Near Field Communication (NFC)*

*To be discussed in great detail shortly, however, to enlighten the reader; NFC is an exciting technology that is starting to become very common in smartphones, it offers a multitude of new possible applications in the tourism industry (Egger, 2013; Pesonen and Horster, 2012 as cited in Borrego et al, 2011). “NFC is a short-range wireless communication technology based on *Radio Frequency Identification (RFID)* technology” (Ozdenizci et al., 2010 as cited in Borrego et al. 2011). “The technology creates a linkage between interoperable systems that provide a wireless short range communication between mobile phones. Hence, *NFC* facilitates information exchange to reach content and services in a heuristic approach” (Jaraba et al., 2010 as cited in Borrego et al. 2011).*

2.4.2.2. *More examples of SMART Tourism Tools in action:*

Before SMART Tourism Tools are discussed in full detail, the below is for the reader to relate to some examples already in operation. These examples bring forth the different aspects of software, hardware and infrastructure for SMART Tourism Tools to function:

Via Software (App, Augmented Reality):

- Visit England offers the ‘Enjoy England’ travel application. It allows tourists to gather ideas and personalise their search according to activities, must-see’s and budget (Neuhofer et al., 2012).
- Visit Britain also offers ‘LoveUK’ app. This is consumer generated by “listing the top 100 locations of the UK ranked by tourists’ Facebook check-ins” (Neuhofer et al., 2012, p. 43)

Via Hardware (RFID, NFC):

- A ski resort in Colorado has designed a guest tracking system using *RFID* technology and a Pennsylvania mountain resort has introduced the *RFID* wristband system. (GUO et al., 2014).
- *SMART Map* has only so far been trialed in tests but it embeds *NFC* tags to a regular paper maps in an attempt to enhance the interaction in a destination (Ronay & Egger, 2014). This allows small information to transfer from paper to smartphone.

Via City infrastructure (Physical objects implemented into environment):

- Stockholm collects real-time information from sensors in the city and processes them in order to provide “accurate city information through end-user devices” (Achaerandio et al. 2011 as cited in Buhalis & Amaranggana, 2013, p. 558).
- Belgium is implementing a ‘TagTagCity’ program which will enable *NFC* users to gain information from tourist locations.

2.4.3. Benefits of SMART Tourism Tools to the Destination

Destinations that provide these types of *SMART Tourism Tools* have the potential to gain the competitive edge (Wang, Li, & Li, 2013). These days, “destinations' competitive advantage comes not only from their resource endowment, but also from their managerial effectiveness and ability for optimal resource allocation which may lead to truly sustainable tourism development” (Laws, 1995 as cited in Wang et al., 2013, p. 61). In this, Hudson and Ritchie (2009 as cited in Neuhofer et al. 2012) “suggest that differentiation is key, as the tangible and intangible attributes of a destination, such as scenery, attractions, heritage and local people are no longer sufficient to distinguish from destinations competing with similar assets”. Therefore, with the wide variety of destination choices, “DMOs need to find means to differentiate themselves, attract consumers and offer distinct value” (Neuhofer et al., 2012, p. 36). An example of this is the *SMART Map* (as previously mentioned) which is “an innovative idea, connecting ubiquitous *ICT* and tourism” (Ronay & Egger, 2014, p. 2).

Furthermore, the successful implementation of *SMART Tourism* has the potential attract Foreign Direct Investment. These investments can last a long time because getting the correct infrastructure in place will shape a destination for the next decades and thus ensuring its sustainability (Buhalis & Amaranggana, 2013).

Benefits of SMART Tourism Tools to the Tourist

The benefits of these *SMART Tourism Tools* to tourists is that the provision of information on tourism products through a variety of technological platforms, brings “convenience of user-friendly interfaces, up-to-date information and affordability” (Yeoman & Yu, 2012, p. 65). Moreover, “with technology being embedded within the destinations environment, it can enrich tourist experiences and enhance destinations competitiveness” (Buhalis & Amaranggana, 2013).

Previous research relevant to SMART Tourism Tools

A small set of SMART services (*Tools*) can be seen in the following Table (1) which shows how the 6A's Destination Components and *SMART Tourism Destination Dimensions* as (taken from Cohen's SMART City Dimensions, representing SMART element) could be combined and possibly generate tourism applications with each of its utility function to be implemented in *SMART Tourism Destinations*.

No.	Tourism applications in smart tourism destinations	Utility function	Destination components (Buhalis 2000)	Smart tourism destinations dimensions (Cohen 2012)
1.	Augmented reality (AR) enables visitors to experience digital recreation of tourism sites and time travel (Chillon 2012)	Interpretation	Attractions	Smart people, smart mobility
2.	Vehicle tracking system provides a real-time information of transport network and could be distributed to end-user devices (Arup 2010)	Planning	Accessibility	Smart living, smart mobility
3.	Hotel should able in predicting energy demand for building and perform energy audits based on their environment management (Metric Stream 2013)	Sustainability	Amenities	Smart environment
4.	A multi-languages application that provide range of services such as electronic travel guide which also offer numbers of available packages for tourists (Jordan 2011)	Guidance	Available packages	Smart people, smart mobility
5.	NFC tags and QR codes to access information about nearby points of interest through mobile devices (GSMA 2012)	Proximity marketing	Activities	Smart mobility
6.	Tourists are able to register their complaints through a Complaints Management	Feedback	Ancillaries	Smart living

Table 1: Tourism applications in SMART Tourism Destinations (Buhalis & Amaranggana, 2013, p. 559)

Buhalis and Amaranggana only briefly touch upon providing details of how *SMART services/tools* can be used effectively in broad situations. However, it is evident specifics are ignored and lack of detail on exact situations/touristic-resources and why. For example in table 1, AR is matched with Attractions, however, neglected is exactly what type of attractions as all attractions vary and therefore this technology would struggle align with every attraction successfully/efficiently. Although, this is a good reference point for destinations to move towards implementing *SMART Tourism Tools*, it clearly highlights the need for a more detailed specification framework on *SMART Tourism Tools* and best uses. Furthermore, Neuhofer et al., (2012, p. 36) argue that with the wide variety of destination choices now available and increased competition among them, it has become highly important “for destinations to find innovative ways to differentiate their products and create experiences that provide distinct value for the tourist”. Thus, showing that destinations need to be aware of future trends in new tourism products in order to stay competitive.

2.5. SMART Tourism Tools in detail

This section of the literature review will take an in-depth look into the current SMART Tourism Tools available, though predominately focusing on Applications (APPs), Augmented Reality (AR) and Near Field Communication (NFC). These tools demonstrate the broadest spectrum of SMART Tourism Tools available at this time and therefore offer most potential in discussing this complex concept. It must be stated that based on the previous outlining of what consists as a SMART Tourism Tool (STT/s), it is logical that STTs are broader than the discussed APPs, AR and NFC technologies. These three SMART Tourism Tools have been chosen for the purpose of this thesis to establish and lay down fundamental foundations for further research, where new technologies and innovations may one day will also be classified as SMART Tourism Tools.

As already established, SMART cities are leading the way in development of new services within tourism. The “SMART” concept is based on the intensive placement of ICT infrastructures as well as on the increase of mobile technology and its APPs. However, a destination is not simply SMART because it makes intensive use of technology but because it “uses technology in order to seek a deeper understanding about the characteristics and meaning of human mobility [...] It uses latent knowledge and capacities to empower local institutions and industries to create knowledge-based policies and advanced mobile services for visitors [...] this infrastructure promotes the creation of advanced mobile tourism applications by tourism stakeholders with tools adapted to people with no programming skills” (Lamsfus et al., 2015, p. 363). Therefore, the ample access tourists have to APPs is highly beneficial to unskilled tech users and thus extending the reach of SMART tools. Further, noting that the applications of Augmented Reality and NFC are still limited, the potential is great within tourism. The following will aim to demonstrate this.

2.6. Applications (APPs)

“The SMARTness concept [...], the use of ICT as a predictive tool to implement a SMARTer way of managing Tourism Destinations” (Achaerandio et al. 2011, as cited in, (Buhalis & Amaranggana, 2013, p. 558).

As previously stated, Smartphones are continuously growing in numbers and the same can be said about APPs. Apple recently published that their App store has more than 1.2 million Apps (Costello 2013, as cited in Kuflik, Wecker, Lanir, & Stock, 2014), and of which almost 48.6 million APPs are downloaded per day (Dediu 2012, as cited in Kuflik et al., 2014). Therefore, the following will bring forth some examples related to tourism. However, there is first a need to clarify the difference between APPs that are ON and Offline, otherwise known as “Native Apps”, “Mobile Web Apps” and “Hybrid Apps”.

2.6.1. Understanding APPs: On & Offline (Native, Web, Hybrid APPs)

Native Apps

Native apps: These live on the physical device and are accessed via icons on the home screen. These apps are installed through application stores like Google Play or Apple’s App Store and more recently Amazon. They are developed for specifically each platform (iOS, Android, etc.) and can take advantage of all the device’s features (the camera, GPS, accelerometer, compass, list of contacts, etc.). They have the potential to incorporate systems gestures and further, define new, app gestures. Finally, native apps can use the device’s notification system and most importantly they can work offline (Budiu, 2013). In reference for tourists, highly beneficial at maintaining low roaming charges and accessing information without internet access.

Mobile Web Apps

Web apps: These are in fact not real applications. In this, they are websites that mimic the look and feel of native applications, but are not implemented within the device (Budiu, 2013). Instead, they run through the browser (Chrome, Safari, etc.) and are written in HTML5.

First, Users must access them as if they were accessing any web page. Web apps became really popular when people realized that they can get native-like functionality in the browser. “Today, as more and more sites use HTML5, the distinction between web apps and regular web pages has become blurry [...] for instance, there are no visible browser buttons or bars” (Budiu, 2013), although it runs in a browser. Due to browser caching, it is even possible to read information offline, as long as it has been previously accessed online earlier.

Also, Web Apps can use the GPS and tap-to-call feature, however, many native features (as stated above: notifications, run in the background, accelerometer information, complex gestures) still remain inaccessible in the browser. If native features are important to the function of the APP then there is an even greater need to create a native app (Budiu, 2013).

Hybrid Apps

Hybrid apps: Part native and part web app. Similar to native apps, they are situated on an app store and are able to take advantage of the device's features. Though, like web apps they rely on HTML being rendered with the browser in embedded within the app.

Often, companies build hybrid apps for an existing web page. In this way, the company hopes to get presence in an app store, without spending substantial effort and cost on developing a new different app. Hybrid apps are popular because they allow cross-platform development and thus reduce development costs: i.e. the same HTML code components can be reused on different mobile operating systems (Budiu, 2013).

In Summary:

Native and hybrid apps are downloaded and installed via an app store, whereas web apps are mobile-optimized webpages that look like an app. Hybrid and web apps both render HTML web pages, but hybrid apps use app-embedded browsers to do that. (Budiu, 2013). Concluding, that native apps offer a better advantage to tourists. This is because they are able to access information directly on their devices without having to pay extra for roaming charges while abroad to gain additional information via the internet. Furthermore, free Wi-Fi may not be available to the tourist when information is required and once again information stored directly on their device enables direct convenience when in a foreign environment. However, hybrid apps do offer an advantages when the environment and app work together, for example, a museum with its own pre-loaded app on a device could link with the free Wi-Fi within the attraction, thus real-time information could be transferred quickly and cost free. Additionally, a highly beneficial proposal if this was used within a transport hub scenario providing live updates.

2.6.2. Different types of APPs:

As established, there are different operating platforms for applications, especially considering their ON and Offline aspects. This section will now take a look at the different APPs and services available to tourists and the public as a whole. Furthermore, due to the rapid development of APPS, a generalisation has been conducted. Following the below analysis of types of APPs, examples of tourism specific APPs has also been reviewed.

APPs during on-site phase

During a trip or onsite phase, tourists continuously search for information and make decisions. The development of mobile technologies has increased the tourist's opportunity to be connected to the Internet almost always. Airports, hotels, transportation, restaurants, and entire destinations are enabling customers to connect to the internet for free (Minazzi, 2015, p. 58). In doing so, tourists usually use multiple devices during the various stages of travel planning, however, during the onsite phase it is considerably apparent that there is growing importance of mobile devices, especially smartphones (Expedia, ComScore-Expedia Media Solutions 2013 as cited in Minazzi, 2015). The main activities in regards

to information searches are about: weather, restaurants, reviews and activities (Expedia, comScore 2013 as cited in Minazzi, 2015). Therefore, destinations are in an ideal position to not just provide the infrastructure for SMART Tourism Tools but also offer the software, i.e. Applications (APPs), and thus increasing the touch points with its visitors. This is important because “tourism boards that are getting in the APP game need to form real partnerships to bridge app user activity with referral information to benefit both attractions and hotels and in-market silent travellers” (Manalo, 2015). Meaning that these “silent travellers” no longer ask for information, they consult with their devices so destinations must find new ways to interact with its clients.

Information search/needs via APPs

Fuchs et al. (2011, as cited in Sabic & Zanker, 2015, p. 495) states in regards to Mobile Tourist Guides that “Mobile information services show great potential both as an on-site information source for customers and as a communication and distribution channel for tourism providers” . Highlighting the benefits for users and the destination itself are equally as important.

Chen and Qi (2010, as cited in Sabic & Zanker, 2015, p. 495) documented the results of a study into “Information Needs” of travellers. The results showed the influence of different context factors (location, time, activity) on tourists Information Needs. Moreover, they added that there was an importance for location-awareness for mobile services when travellers are out sightseeing and/or searching for transportation/accommodation. Thus, indicating a strong interest of users for finding information when on the go. For Tourism, it is one of the area where a strong supply of mobile smart services can help enrich the user experience. In this, Gretzel (2011, as cited in Sabic & Zanker, 2015, p. 495) adds that the “more enjoyable tourism experience” comes from the better access to “more relevant information, greater decision-support” and “greater mobility”.

Business travellers are a good example of mobile users who information search on the go. They use APPs to make real-time decisions about transportation, hotels, restaurants, etc., i.e. the APP “Tonight” from Booking.com and “Hotel tonight” (Chilli6n, 2014) basic principles are to satisfy the need of travellers quickly to identify a hotel nearby. This booking system in the APP is already set on the current day, hence “tonight”, and users have only to decide the order of hotels based on popularity, location, price, and rating. In fact, a wide range of location-based APPs allow tourists to commit real-time decisions about nearby services at a destination. Another example, “Foursquare” locates services near the tourist/user who can share their position to contacts by means of “check-in.” (Minazzi, 2015, p. 58). This being clear example of tourists generating the promotion of destinations through recommendation.

Location based (Awareness) APPs

Location based APPs uses the GPS function of Smartphones. In doing so, they are able to provide information on current location and/or nearby POI’s. These APPs predominately utilise content that has been previously downloaded to the mobile device. Due to the GPS being reliant satellite positioning, it

therefore does not require access to the internet and thus roaming charges are not incurred. However, in some cases certain APPs may request additional information. In this case, data will be required via a mobile network or Wi-Fi. An example of this can be seen with the Google Maps APP; the user can download a map over Wi-Fi and then use the map without the need for an internet connection later on. Though, if the user desires further information such as traffic reports, there will be a need for access to the internet. Even though a user may have no access to internet the APP is still extremely useful at providing valuable content on location.

Social media APPs

Social media allows tourists to share messages, photos, and videos while away. This user generated content (UGC) posted to online platforms enables users to keep their close circles in constant touch through more than just words. Minazzi (2015, p. 58) points out that “tourism activities are highly related to visual content (photos and videos) that, when sent by mobile phones or posted on social media, become a form of *new postcard*”. Recent research demonstrates the growing importance of social media in the onsite phase of travel planning, predominantly due to the development of mobile tech (Munar and Jacobsen 2014; Xiang et al. 2014 as cited in Minazzi, 2015). Social networks are highly suitable for tourism activities because many users want generally share their trip in that moment with their network of friends. When traveling, new experiences can be easily shared with a post on Facebook or a pin on Pinterest with the photos of the local food that is in front of them, or the beautiful view they are watching (Minazzi, 2015). For a destination, a method for utilisation of this technology could be to integrate it into their own APPs. For example, a conference being held in the city could deliver live updates on event proceedings via a designated conference app. Furthermore, prompting its participants to ‘share’ their own experiences via ‘tags’.

Review APPs

Travellers will also share their activity during the trip phase by posting opinions on travel review websites, such as the TripAdvisor APP, rating, publishing photos and describing the experience. This feedback could be a great opportunity for destinations and hotels that usually host the traveller. An example would, if a complaint for a hotel/attraction about staff is made it could promptly intervened to try a recovery when the customer is still at the hotel/attraction. However, this would require a real-time management of social media by employees (Minazzi, 2015).

Commerce APPs

Commerce APPs provide simplified versions of the website platforms designed for buying things. Generally, these types of APPs rely on continuous connection with the internet in order to maintain the most up to date prices and stock availability. These Commerce APPs are highly useful for brands to directly communicate their messages and build stronger relationships with clients. In regards to tourism, they have the potential to offer purchasing ticket opportunities for tourists to gain admittance to attractions. However, more commonly in tourism, software such as this can be found more within “Booking APPs”. Here consumers are able to compare best prices and make bookings based on less information. For the on-

site phase of travel, these APPs are considered to be based a convenience context rather than a detailed excursion plan. Moreover, APPs that provide purchasing ability on top of information can increase the perceived value by users. Additionally, enabling tourists to apply credit to public travel cards via APPs also provides ease whilst in a new destination.

2.6.3. Tourism specific APPs: Examples

The review that follows highlights examples of tourism specific APPs designed for tourist use:

The Tourist Guide: The new Digital guide book

Tourist Guide applications are becoming very common in many locations. Destinations such as Malaga and Barcelona have created native tourism board APPs. These applications are pre-installed by the user before arriving at the destination. In doing so, tourists are able to explore the area and familiarise themselves with key attractions, furthermore, they are able to gain information on local resources. The Malaga “Tourist Guide” APP (Ayuntamiento de Malaga, 2015) additionally combines written text with audio tracks that can be played before or at the specific attraction in reference. The Barcelona “iBarcelona – Smartour” APP (Barcelona Turisme, 2015) is another application in addition to its tourist guide. However, this APP incorporates Augmented Reality (to be discussed in further detail later) which enhances user experience through visual effects.

APPs in Cultural Heritage

Recent technological developments have already shown a wide range of **Cultural Heritage** related applications being developed. These APPs have the potential to provide detailed context awareness of surroundings and off location based (Awareness) services.

However, in the past there were some issues with location awareness but thankfully these have been addressed by recent research. In this, the outdoor positioning problem has almost been completely solved by GPS which is commonly used for location awareness in Cultural heritage (Van Aart et al. 2010, as cited in (Kuflik, Wecker, Lanir, & Stock, 2014, p. 6). Also, a combination of Near Field Communication (NFC; to be detailed shortly) for positioning, fixed beacon technology for indoor positioning to provide delivery of context aware information and QR-codes as location points have improved the recent successfulness of digitally aided cultural sites (Kuflik et al., 2014, p. 6).

Tourists are now able to make real-time decisions about services directly at the destination and within cultural sites because of mobile tracking. In addition, “travellers can manage unexpected situations and complete travel activities more efficiently and effectively” (Minazzi & Mauri, 2015, p. 511).

Furthermore, ICT developments in applying context aware services to Cultural Heritage has increased the interest in the use of Augmented Reality (AR) APPs which provides layered information when to the smartphones camera when in use (Kuflik et al., 2014). As previously stated, Cloud computing and IoT is making this possible for cultural sites to implement and maintain attraction competitiveness. *AR will be discussed in deeper detail shortly.*

The following examples* can be found in Appendix 1 in full detail. These examples provide further context on how APPs can function in different areas/ways in a destination.

Location specific APPs:

* *Airport*

Digital Passport and Customs declaration.

* *Airlines*

Review flights & control in-flight entertainment.

* *Hotels*

SMART hotels: Bookings, access & room functions via APP.

Further Tourism APP Examples:

* *Malaga tourist guide / audio app*

Digital offline audio tours free.

* *Museum APPs*

Adding value to the traditional museum with digital content.

* *Seoul City, Korea: Tourism APP*

Providing all necessary tourist information. Integration of Augmented Reality. Offering smartphone rental to avoid roaming costs.

* *Conference APPs*

Enhancing communication and real-time information for valuable short periods of time.

2.7. Augmented Reality (AR)

“The potential impact augmented reality can have on tourism is very exciting, and the possibilities are endless” (Chillión, 2014)

Augmented Reality (AR) is a form of application, however, it is heavy reliant on its need for extra hardware, in this case the mobile device’s inbuilt camera. Therefore, this SMART Tourism Tool provides information through imagery. The following now explores the deeper aspects of this technology.

2.7.1. Understanding Augmented Reality

As the recent advances in mobile computing and wireless has been demonstrated, there have also been advances in computer graphics and sensor technologies which have allowed for the rapid development of AR APPs on smartphones (Yovcheva, Buhalis, & Gatzidis, 2012, p. 63). AR systems enhance/augment the surrounding environment of “the user with virtual information that is registered in 3D space and seems to coexist with the real world” (Azuma et al., 2001 as cited in (Yovcheva et al., 2012, p. 63). In fact, these 3D images of information are “superimposed” on the real-world view (Lee et al. 2015, p. 478)

Smartphones combine all necessary technologies for augmentation to enable the mass market access to AR which has massive potential for tourism (Höllerer & Feiner, 2004; Seo et al., 2011 as cited in Yovcheva et al., 2012, p. 63). Lee et al. (2015) also add that “explosive growth” of the smartphone market has aided AR function to become more accessible to a wider audience.

2.7.2. Motives to use Augmented Reality

Tom Hall, editor of Lonely Planet Travel (Chilli3n, 2014) wrote that “Augmented reality can help in both practical and inspirational ways. Firstly, it can open your eyes to what’s around you. When travelling, you spend a lot of time actively looking both at and for things and AR is an obvious companion for this. It helps you find places and sights that may otherwise be tricky. And it gives users a new route into accessing travel information”. In essence, this statement brings forth the idea of enhancing tourism experiences. AR is not designed to inhibit journeys but it is to get the most from the destination while there and inevitably the constraints of time.

2.7.3. Augmented Reality for Outdoor use:

The user points the device (typically a GPS-based smartphone) towards physical objects in the surrounding area. They are then able to see overlay of virtual information on top of the real world camera view through “virtual annotations”. content type and extent of information in the virtual annotations varies in each application but can sometimes include either/or video, images, text or symbols for different types of points of Interest (Yovcheva et al., 2012, p. 63).

Type of tourism information offered by AR:

Currently, AR tourism Information that currently is predominantly being offered to the tourists is:

- Descriptions of tourist attractions,
- Restaurants (services, etc.),
- And monuments (POIs).

However, also useful information such as nearby services (Wi-Fi hotspots, ATMs, parking, transportation, local news items, and weather) can be displayed. Furthermore, some apps offer geo-coded user generated content/social media, i.e. tweets, recommendations, videos and photos about a place (Yovcheva et al., 2012). Figure (2) visualises these examples:



Figure 2: Augmented Reality in action 1 (Yovcheva et al., 2012, p.65)

The different functions possible with AR

The table (2) below highlights the possible functions that AR can offer in a tourism context:

Functionality	Description
1. Search and Browse	Search and browsing (categorical search) mechanism provides access to relevant information (Rasinger et al., 2009).
3. Context-aware push	The tourist may miss out on important/interesting information, especially in information-rich urban settings (Rasinger et al., 2009).
4. m-Commerce	The possibility for booking/reservation and payment (Rasinger et al., 2009).
5. Feedback	A mechanism to provide and/or receive feedback from/to other tourists or tourism authorities (Rasinger et al., 2009).
6. Routing and navigation	The possibility to obtain directions and navigation to a POI, once it is visualized in AR view and selected (Umlauf et al., 2003).
7. Tour generation	Adding POIs to a (pre-generated) itinerary allows tourists to plan better and manage their leisure experience (Umlauf et al., 2003).
8. Map services	Helps tourists to obtain an overview of a larger territory (Suh et al., 2010).
9. Communication	Option to realize direct contact with accommodation providers, exhibition owners and others involved in service provision (Rasinger et al., 2009).
10. Exploration of visible surroundings	Apart from looking up for information about a particular item, place, object and category, tourists may wish to “explore” available information about their surroundings without pre-defined criteria (Ajanki et al., 2010).
11. Interactive AR view	A “clickable” AR view could serve as an interface to additional, more detailed information about a point of interest (Wither et al., 2009).
12. Filtering of AR content	The option to filter and change interactively the visualized content in AR view. This is an important feature, keeping in mind that urban environments are rich in potential targets for annotation (Tokusho and Feiner, 2009).

Table 2: Selected criteria for the comparative overview and evaluation (Yovcheva et al., 2012, p. 63)

Yovcheva et al.'s, (2012) research concluded that the 12 above functions were the extent of which AR could be used with a tourism setting (at current). These functions could either be used solo or in conjunction with each other and provide a wider service to the tourist. In addition to the normal search and browse functions, Yovcheva et al. also noted that the function “Exploration” was one of the biggest advantages of AR to tourists, which displays the immediate visible surroundings and overlaid information. This then obviously plays a logical role when tourists are in an unfamiliar place looking for directions or enquiring about the touristic sites nearby. Moreover, it enables the tourist to explore available content without having specific background knowledge of the destination.

In addition, AR APPs that provide an interactive display with a “clickable” function can expand to offer more information about the POI, open local maps or open a new screen with more detailed information increases the depth of the content and the user experience through offering more value (Yovcheva et al., 2012).

2.7.4. Example types of AR APPs

This section clarifies the different types of Augmented Reality APPs used in tourism. The general variances can be better seen in this way before defining current examples in use.

AR in Cultural Heritage tourism

AR allows visitors to have a digital experience of a place and, within reason, take them to another time in history. With the increased number of tech-savvy travellers, travel guides can now come to life in real-time as visitors visualise historical places in 3D through the use of AR (Chilli3n, 2014). It “is one of the

emerging technologies used in cultural heritage tourism sites around the world” (Lee, Chung, & Jung, 2015, p. 477). Portale’s et al. (2009 as cited in Lee et al. 2015) also state that cultural heritage tourism is one of the most important areas served by AR. It provides digitally restored artefacts which help prevent further degradation of cultural heritage sites affected by regular visitors and lets the user perceive fun and usefulness of the site in a new way (Haugstvedt and Krogstie 2012 as cited in Lee et al. 2015).

It must too be mentioned, that Heritage is not solely restricted to just attractions or contained areas but it can consist of a whole city, for example, Dublin and Venice are considered to be Heritage cities and thus attractions in themselves. Concluding on these examples and others alike, that the whole destination is considered to be a heritage site whereas other destinations might simply prosper most through specific tourism attractions (Han, Jung, & Gibson, 2013). In regards to AR, this technology is not just bound to small areas but also whole destinations.

[Re-living historic life and events through AR](#)

AR lends itself naturally to the re-creation of ancient temples and historic buildings. Already there are numerous developed prototypes and commercial systems to which some will be explored later in more detail. However, the first cultural heritage site that benefited from AR was the reconstruction of the ancient Olympia temple in Greece, where researchers developed the “ArcheoGuide AR system”, a complex infrastructure of data and ICT. This technology lays much of the foundation for what is now used in AR functionality (Todorov, 2013, p. 7).

[Places implementing cultural heritage AR](#)

A number of heritage sites and tourism organisations around the globe have recently developed and are providing mobile AR apps to its visitors. Examples of this are at attractions like the Deoksugung & Gyeongbokgung Palace in Seoul, the Post Museum in Dublin, the Louvre in Paris and the British Museum in central London (Lee et al., 2015, p. 478).

The following section presents a selection of current AR applications:

[Tuscany+:](#)

Specifically developed for the Tuscany region, Italy, it operates similar to a digital tourist guide. Information is sourced from Internet pages like Wikipedia, Google Places and the Tourism Boards official page. Tuscany+ delivers tourist information regarding **accommodation, dining, the city’s nightlife and sightseeing** (Fondazione-Sistema-Toscana, 2010). All information is displayed through the camera function and overlaid on the screen, as in all cases of AR. The motive of the APP is to discover what is around oneself.

[Augmented Reality for Basel: AR tourist guide.](#)

Available in English, German, French and Spanish. Content is derived solely from the city's dedicated database. Users can access valuable information for the city and its outskirts. Specifically, information is provided on **local sites, museums, restaurants, shopping and hotels**. information on **events** is also available during these occasions (mCRUMBS, 2011).

[Urban Sleuth](#)

This AR APP is designed as a "real life city adventure" in which users seek to solve mysteries and partake in missions while touring the city (NYC, Boston, Chicago, LA, and San Fran). The application combines the real world with being a virtual detective. the missions are designed so that participants/teams discover **neighbourhoods and historical monuments** (Kounavis, Kasimati, & Zamani, 2012, p. 3). This APP creates exploring a city with gamification while on holiday. Thus, providing new and innovative ways for tourists to experience a destination.

[StreetMuseum](#)

Launched by the Museum of London, this AR APP provides interesting opportunities for visitors/tourists. Moreover, it also brings a platform for tourism brands/affiliates to exploit marketing opportunities. This APP recognises the location and overlays historical images and videos of that area/building. Hundreds of images from Museum of London's collection have been stored into this APP, including the 1666 Great Fire to the 60's and "the results are astonishing" (Chilli6n, 2014). This APP brings the **city and its streets** history alive. It enables users to explore the city in a new way and gain experience through being in the same location as history. "StreetMuseum offers also a trail functionality in which tourists can design their route beforehand and discover the **city's history or identify altered landscapes and important landmarks**" (Thumbspark_Limited, 2010). Figure 3 below illustrates StreetMuseum in action:

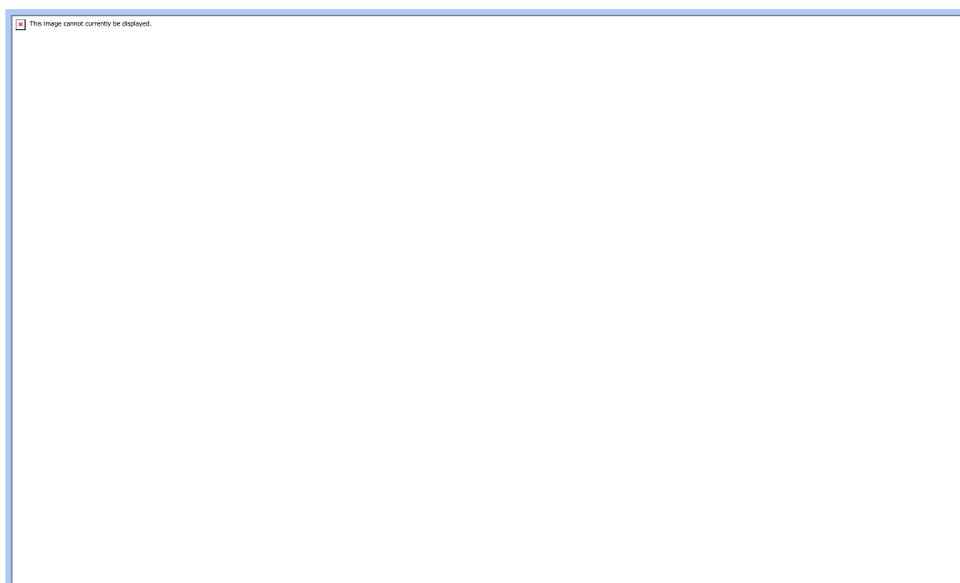


Figure 3: Augmented reality in action 2 (Sung, 2011)

Living History

The APP “Living History” at the Union Station Kansas City brings history to life in the exact spot where it took place in a similar way to the StreetMuseum APP, London. However, this APP layers film footage of **historical events and celebrities**, such as a young Walt Disney, Ernest Hemingway, and events like the 1933 Kansas City Massacre. “Historic train stations are not often on the top of tourists’ must-see lists” (Shankman, 2014). Therefore, Users are required be physically present at Union Station to activate the AR, thus encouraging tourists to stop at the station and spend time there. In addition to layering past events/people, app users are able to take a photo of themselves interacting in the AR images. Tourists can “share them on social media, making the app a clever marketing tool” (Shankman, 2014). This APP shows the innovativeness to revitalise old buildings through digital media and modernise attractions to meet the desires of modern tourists.

Examples of AR APPs in tourism destinations

The following builds on the previous examples of AR Cultural Heritage APPs and takes a look at the wider AR APPs catering for the other touristic resources in destinations. A detailed review of each can be found in Appendix 2.

AR APPs in services:

GraffitiGeo

Providing food & beverage **recommendations**.

Yelp: AR browser

Providing recommendations to local facilities & attractions.

Madrid Subway: Augmented transportation

Providing **navigation** & real-time information.

Google Translation: Augmented reality translation

Superimposing **translations** overlaid on real world text via AR.

2.7.5. Benefits of Augmented Reality

“Augmented reality on mobile smartphones can also enhance any tourist’s experience by giving them the ability to access additional information or images associated with a priceless, historical work of art or an historic place, simply by viewing it through the smartphone” (Chilli6n, 2014).

Educational

Todorov (2013, p. 3) concluded that AR in a museum setting had benefits in an educational environment. He states in his research that “education is one of the areas which have benefited the most from AR since the technology provides a tangible interface which stimulates both mental and motor activities through an intuitive interaction with unfamiliar content. Educationally rich visits and visitor engagement is also one of the most important factors in the tourism industry and AR has huge potential to actively involve tourists in learning about and experiencing various museum settings and artefacts like never before”.

Todorov further argues that AR can make the “static contents of a museum come to life, leading to an interactive, dynamic and interesting adventure which increases visitor retention time and return visits”

(Todorov, 2013, p. 3). Moreover, AR in museums can simulate impossible experiences as it are able to “revive extinct animal species, worn-out frescos or fragmented cultural artefacts” (Todorov, 2013, p. 3).

Cultural Heritage: Art Galleries

Leue, Jung, & tom Dieck's (2015) research on AR in cultural heritage found that there was enormous opportunities to enhance user experience and learning outcomes. Their study identified a positive attitude from tourists to use augmented reality as an enhancer of the **art gallery** learning and their overall visit experience.

Moreover, the positive aspects found in Augmented Reality is that similar to audio guides which is that not all visitors are required to use it. Thus, “visitors who benefit from an enhanced learning experience and are curious to try it out can do so without interrupting fellow visitors” (Leue et al., 2015, p. 474). Therefore, art galleries should feel encouraged to offer visitors an AR experience in order to enhance the learning possibilities, attract potentially new markets and provide more interactive experiences.

2.7.6. Augmented Reality Disadvantages

It is important to recognise the downsides of AR. In the urban environment context, tourists enabled by technology, are now able to navigate their way through unknown areas without the use of physical maps, guidebooks or dictionaries – “a trend that is already present in Tokyo” (Yeoman & Yu, 2012, p. 69). However, the disadvantage of this could be the rise of the so-called “silent traveller” (Manalo, 2015) as previously stated. (Chillión, 2014) also points out that the risk of AR may cause visitors to become totally absorbed in operating screens on their smartphones, and therefore “disconnecting from reality” by not looking, touching, moving around or/and imagining past events whilst in the remains of a cultural site for example. Moreover, the instant access to question being answered removes to the need to interact with locals and discover more of a local culture.

Data Protection

Similar to most location based APPs, AR applications have access to personalised and private data stored on the mobile devices, generally this information is on current location but this is good for providing relevant and updated information on that specific location. Further, information about POI's can be placed immediately in context. It must also be noted, there is still a lack of adoption by tourists to use this technology (Olsson & Väänänen-Vainio-Mattila, 2011, as cited in Yovcheva et al., 2012), simple due many people having limited tech experience to use confidently and in many cases preferring more traditional sources like paper guidebooks (Han et al., 2013, p. 514). However, Fritz et al. (2005, as cited in Han et al., 2013) points out that AR has “high potential in becoming a main-stream technological tool in tourism in the near future” due to its “practical usefulness” indoors and outside.

2.7.7. The Future of AR

in terms of the future, as urbanised environments become even more ubiquitous and well networked through IoT, vast amounts of data will become increasingly more available at the swipe of a tourist's thumb (Howells, 2009 as cited in Yeoman & Yu, 2012, p. 69), thus highlighting a strong need for destinations to incorporate these trends and provide the services reflecting demand of younger generations, such a Gen-Y and after, even if some generations are late adapters.

“The full potential of smartphone AR for Tourism is still not widely explored”

(Yovcheva et al., 2012, p. 63).

Augmented Reality Case Study

The following case study can be found in Appendix 2.

The Dublin AR project & Findings

Superimposed tourism information, digital re-constructions and stories of the past, to create emotional experience of the intangible products for tourists.

2.7.8. AR Considerations for implementation & requirements of expected service

In summary, based on Yovcheva et al., (2012, pp. 65–66) research, it was found that when it comes to the needs of tourists during on-site phase, AR applications should support the following to be effective:

- 1) Provide access to location-based information which relevant to the direct surroundings of the user,
- 2) Enable access to variable content which is timely and updated (i.e. transport information),
- 3) Flexible: in terms of delivering text, video, or/and images,
- 4) Provide interactive annotations that are integrated with map services and additional information.

Furthermore, Augmented Reality has the ability to diversify tourism products and thus extending the range of services on offer to a destination. Further, through applying new ICT technologies like AR, destinations can remain competitive and respond to the growing trends of the modern world.

2.8. Near Field Communication (NFC)

“A very promising technology that will most probably be integrated in our smartphones, offering a variety of new applications for the tourism industry, is the wireless connectivity technology Near Field Communication (NFC)” (Ronay & Egger, 2013b).

The following will seek to explore the SMART Tourism Tool of Near Field communication, more commonly referred to as NFC. In addition, to defining NFC, the benefits and links with tourism will be reviewed. Furthermore, current examples of NFC in tourism use will be demonstrated.

2.8.1. Status Quo

Pesonen & Horster, (2012) state that NFC has the potential to make a big impact on both the tourism business and tourism research. Furthermore, is “predicted to be one of the next big things in technological progress (Pesonen & Horster, 2012, p. 11). Buhalis and Law (2008) also add to this by arguing that mobile

wireless technologies (ubiquitous computing) is one of the most interesting areas within technological innovation of tourism. This “technological progress and tourism have been gone hand in hand for years” (Sheldon, 1997; Poon, 1993, as cited in Buhalis and Law, 2008, p.2). Therefore, it is important for tourism professional to gain better understanding of the current and future possibilities of NFC technology in tourism. Moreover, NFC offers many opportunities for application within tourism and thus deserves a deeper examination by tourism professionals (Pesonen & Horster, 2012, p. 11). Even though most ICT developments are not made directly for tourism, these advancements have a great impact on tourism as a whole (Guttenber, 2010, as cited by Pesonen & Horster, 2012, p. 11) and as will be further explored in this chapter.

As established, the number of mobile devices (smartphones and tablets) has increased in recent years and use of them in the on-site travel phase. Clearly making this subject crucial from a tourism management perspective to be discussed. Thus it is understandable when Pesonen & Horster, (2012) state that as one of the most recent ICT developments, NFC has the potential to make a noticeable impact on the travel and tourism industry, in specifically for stakeholders at the destination level.

2.8.2. Understanding NFC

NFC technology is a combination of the contactless radio frequency identification technology (RFID) and hardware (Smartphones, tablets, etc...) that facilitates a wireless connection (Borrego-Jaraba et al., 2011, pp. 731–732). As standard, most recent mobile devices now support NFC inbuilt. This simple means that wireless technology is able to data transfer/exchange without physical touch. It is instigated via an initial short range encounter of two independent devices, either two smartphones (for example, exchanging pictures just by bringing the two capable NFC devices close together) or a single smartphone (acting as a reader) over an information source (such as programmed NFC tag/ RFID chip hidden in a poster next to an artefact in a museum) which would launch a pre-installed APP or access a dedicated website link (Pesonen & Horster, 2012). This NFC technique facilitates and enhances these short-range connections (Boes, Borde, & Egger, 2015, p. 435) and thus reduces the requirements for connections to be made by the user, as for example in Bluetooth setup’s where passwords must be shared and connections searched for.

Borrego-Jaraba et al. (2011, pp. 731) argues that this simple solution is based on the “touching paradigm [...] makes possible the information exchange and access to content and services in an intuitive way”, furthermore, “it simplifies people’s interaction with the environment, resulting in the Touch Computing paradigm, where users get their mobile device close to everyday life objects, dotted with visual marks and RFID Tags or other NFC devices, with the aim of triggering the intelligent services offered by those objects”.

Linking this back earlier to the involvement of ‘Internet of Things’ (IoT), NFC brings the concept of ubiquitous computing closer to reality (Kuflik et al., 2014). Thus, the link between various things/objects can be further made. As NFC is seen as a natural way of providing interaction between users and their

surroundings, its characteristics of non-touch and instant setup makes it the ideal “candidate for the development of intelligent ambient” (Borrego-Jaraba et al., 2011, pp. 731–732) and hence advancing IoT.

Comparing wireless technologies

Dubey, Giri and Sahere (2011, as cited in Pesonen & Horster, 2012, p. 12) created the comparison table of different wireless technologies below (Table 3).

Comparison of different wireless technologies (Dubey et al., 2011).			
	NFC	RFID	Bluetooth
Set-up time	<0.1 ms	<0.1 ms	6 sec
Range	Up to 10 cm	Up to 3 m	Up to 30 m
Usability	Human centric Easy, intuitive, fast	Item centric Easy	Data centric Medium
Selectivity	High, given, security	Partly given	Who are you?
Use cases	Pay, get access, share, initiate service, easy set up	Item tracking	Network for data exchange, headset
Consumer experience	Touch, wave, simply connect	Get information	Configuration needed

Table 3: Comparison of Wireless Technologies (Dubey et al. 2011, as cited in Pesonen & Horster, 2012, p. 12)

As can be seen, compared to other technologies NFC has the fastest set-up time. Moreover, NFC has “better usability, more use cases and better consumer experience” (Pesonen & Horster, 2012, p. 12).

Pesonen & Horster (2012) also noted that a key advantage of NFC compared to Bluetooth/Wi-Fi is the fast and automated connection without password authorisation. Although, NFC can be used to aid the quick set up a Bluetooth/Wi-Fi connections automatically. In this, NFC then acts as an “enabler” to other connection types.

Furthermore, it is now important to clarify the differences between NFC and RFID technologies. Even though very similar, RFID focuses on identification whereas NFC is designed towards interaction. Ok et al. (2010, p. 335, as cited in Pesonen et al., 2012, p.12), argue in their research that there are three main operating modes for NFC. Which are:

- In card-emulation mode: data is transferred from Smart-device to NFC-Reader,
- In reader/writer mode: data is transferred from an NFC tag to mobile device or vice versa,
- And in peer-to-peer mode: data is transferred between two NFC compatible devices.

The benefits of these will be demonstrated shortly.

2.8.3. Benefits of NFC

*“In combination with NFC, the device will act as a **smart-key** to gain access to services from any other NFC device or tag” (Pesonen & Horster, 2012, p. 11).*

NFC enables communication between two devices in a simple and secure way by bringing them closely together. Communication is instantly stopped when the devices are moved away from each other. Highly beneficial for users without knowledge on networks/technology data connections, meaning it is easy to use. The short range radius of initial connection also increases security as no other NFC enabled device can intercept the communication without being noticed. Moreover, NFC supports a “passive mode of communication” which means that devices do not generate any RF fields and can complete communication when only one end device is powered, thus great energy saving benefits (Csapodi & Nagy, 2007, as cited in, Pesonen et al., 2012, p.12).

Importantly, the reader should note that NFC is already compatible with the current RFID infrastructures in use. For example, contactless smart cards and public transport readers. Therefore, much of the investment in modernising urban destinations has already been implemented and thus NFC enables the extension of services on offer. In this, swiping the back of a smartphone to pay for a train journey instead of a travel card. Ondrus and Pigneur (2007 as cited in Pesonen & Horster, 2012, p. 12) argue this point when saying “the performance of NFC technology is better than traditional payment cards and mobile methods”.

As discussed earlier, Ok et al.’s NFC operating modes (In card-emulation mode, in reader/writer mode and in peer-to-peer mode) research also stated the perceived benefits of each were. In the table (4) below, these are outlined:

Benefits and future scenarios for different NFC operating modes (Ok et al., 2010).			
	Card emulation mode	Reader/writer mode	Peer-to-peer mode
Benefits	<ol style="list-style-type: none"> 1. Physical Object Elimination 2. Access Control 	<ol style="list-style-type: none"> 1. Increases mobility 2. Decreases physical effort 3. Ability to be adapted by many scenarios 4. Easy to implement 	<ol style="list-style-type: none"> 1. Easy data exchange between devices 2. Device pairing
Future scenarios	<ol style="list-style-type: none"> 1. Integration of id-cards, passports, finger-prints, driver-license 2. Storage area for critical information to provide user's privacy and authorizing people to access those information 	<p>Many real-life scenarios can be adapted to NFC in this mode. In all of the scenarios, some data need to be read from an NFC tag, and additional jobs need to be done by NFC-enabled mobile phone.</p>	<ol style="list-style-type: none"> 1. Secure exchange of critical data 2. Gossiping

Table 4: Benefits of NFC operating modes (Ok et al., 2010, as cited in Pesonen & Horster, 2012, p.12)

As can be seen in the above table, there are many possible applications of NFC (ranging from access control to communication). However, these three operating modes neglect some of the crucial aspects of NFC linked to tourism. Therefore, in the latter of this chapter case studies will be reviewed where NFC has been used or trialled by tourism businesses to gain a better perspective for this thesis.

Benefit Examples

User experiences

Ho and Chen (2011, as cited in Pesonen & Horster, 2012) detailed a demonstration of how NFC technology could be used to improve “user satisfaction” within **food service industry**. Their results were based on a real-life theoretical example of a customer called “Sam” who attends restaurant “A” to have food. It was proposed that if the **restaurant** is equipped with an NFC device at the table, the restaurant would be able to send him a special menu and/or discounts when “Sam” scans his mobile phone on the NFC device. For example, if Sam has special dietary requirements, like being a vegetarian then the owners could send only their vegetarian options to his smartphone. Thus, it is believed that the customer’s experience is not only altered but enhanced.

Convenience

Hotels are also in a key position to exploit the benefits of NFC technology. Ok et al. (2010, as cited in Pesonen & Horster, 2012) showed the value of “NFC with automated **check-in system**” for hotels. This was possible through a specifically designed NFC application for that facility. In this example, the guests receive their room information and digital key directly to the smart device at the exact moment the room is booked

via the APP. Thus, when the guests arrive at the hotel they are not required to wait in the check-in line and can proceed directly to the allocated room and open it with their own device. Moreover, the smartphone can also be used with in the room to control certain features, like lighting, heating and TV. Checkout can be done through an NFC enabled kiosk at reception on departure. The hotel “HUB” (*more detailed in Appendix 1*) in central London opened late 2014 has already had much positive feedback on this concept where visitors are happy to have less contact with staff (Premier Inn, 2014).

2.8.4. NFC Disadvantages:

Threats and issues to NFC

Several authors have reported on the negative sides of NFC. These are issues that NFC users and developers should be aware of when considering the technology.

According to Kostakos and O'Neill (2007 as cited in Pesonen & Horster, 2012) while NFC is taking place users cannot easily read information on their devices. In addition, the device's lights and vibrator become active to notify the user of the status of the data exchange. Crucially though, NFC must be “adopted by both consumers and traders in order to develop the required infrastructure” (Ondrus & Pigneur, 2007 as cited in Pesonen & Horster, 2012, p. 13). Therefore, NFC will struggle to succeed unless a large number of NFC devices/facilities are available.

Security

Madlmayr, Langer, Kantner, & Scharinger (2008) reviewed several security and privacy issues in NFC devices. They found seven cases that are exposed to attack, these are:

- 1) Denial of service (Blocked access),
- 2) Relay data transferred over the radio frequency (interception of data),
- 3) Skimming of applications in the secure element (digital pickpocketing),
- 4) Managing in-device security,
- 5) Transactions over NFC peer link (untrusted source),
- 6) Issues due to the fixed unique ID, and
- 7) Phishing (fraudulent interception of personal data).

Mulliner (2009, as cited in, Pesonen & Horster, 2012) studied the vulnerability of NFC devices and described similar attacks above on NFC phones and services. From this he developed security testing for NFC devices and services that can be used to protect users and for destinations to apply. Though the best security for participants is to be always aware and competent of own actions while using digital devices and services. This can add an extra layer of vigilant protection on top of pre-installed personal security software.

2.8.5. NFC in tourism

The following will explore the potential of NFC technology within tourism.

(Ronay & Egger, 2013a, p. 568) state that NFC can have a significant and positive impact on the travel and tourism industry. This is due to NFC being able to offer a range of possible functions the tourism to utilise, such as mobile payment, information supply, access authorisation, object identification, system

management, and location based services etc. In addition, through developing strong infrastructure Smart cities have the potential to attract investors and create significant economic benefits (Ronay & Egger, 2013a, p. 568).

Potential of NFC technology in general

The table (5) below highlights several researchers’ work who have brought forth the aspects of NFC technology in general. The table was formed on the literature of Pesonen & Horster (2012, p. 14) research on NFC in tourism and demonstrates how it could be possible used by tourists.

Researcher/s	Outcome: NFC usage
Madlmayr et al. (2008)	Communication flows for NFC devices: loyalty, payment, Bluetooth and Wi-Fi configuration, VCard transfer, Smart Poster, data exchange, Over-the-Air provisioning, ticketing and money top up’s.
Fischer (2009)	Possible applications for NFC technology: Electronic wallet (could each replace a credit/debit/transportation/access, and/or loyalty cards). NFC could also be used with NFC enabled vending machines.
Opperman and Hancke (2011)	NFC can facilitate the process of data acquisition from a sensor device and is ideal for those with little tech knowledge.
Ho and Chen (2011)	Six different uses for NFC technology: Electronic ticketing, data exchange, electronic wallet, rating, Bluetooth pairing and smart posters.

Table 5: Potential of NFC technology (as cited in Pesonen & Horster, 2012, p. 14)

NFC technology offers many uses to tourism practitioners and the tourists. As the result of the literature reviewed and case studies outlined above, the table (6) below displays these earlier NFC in tourism uses.

NFC in tourism.	
	Tourism practitioners and tourists
Business models and ecosystems	Marketing
Software and applications	Paperless travel
	Check-in and check-out with NFC in accommodation companies
	NFC payment options
	Ability to track visitor movements
	Connectivity with social networks
	Smart posters and destination tagging
	Tourist pocket guide and diary
	Easier check-in with Foursquare
	Gaming
	Loyalty cards
Security and hardware	Ticketing and timetables
	Infrastructure development
	Secure and private virtual coupons
Threats and issues	Tag authentication
	Lack of handsets supporting NFC
	Maintenance of tags
	Data roaming charges

Table 6: NFC in tourism (Pesonen & Horster, 2012, p. 16)

2.8.6. NFC Case Studies

The following reviews examples of NFC used in tourism. It hopes to highlight to the reader of this thesis a vast array of uses of NFC that could be already plausible within their own destination.

Due to the newness of the subject of NFC in tourism, not a vast amount of research has previously been conducted on the field. However, there are some cases where NFC is currently used in tourism.

To demonstrate the current situation of NFC tech, a selection of cases have been reviewed:

NFC: Smart Poster

Even though the following demonstrates the aspects of Smart posters and how they work, it also brings forth the typical concepts of NFC and how it is possible in other scenarios.

Recently, it has become more frequent for NFC tags to be attached to posters in order to exchange data (such as links/contact details), thus turning them into “smart posters” (Boes et al., 2015, p. 437). This is done through NFC tags being embedded in posters/objects discreetly, thus enabling the integration of NFC tags and smart posters (Hardy et al. 2010, as cited in, Boes et al., 2015). The ability to combine a physical object with digital information creates many opportunities for tourism/service providers. Furthermore, Smart posters are perceived to be highly user friendly with little amount of effort required by the user (Boes et al., 2015). *An example of the described Smart poster can be found in Appendix 6.*

For tourism/service providers, these posters enable interaction with clients, supply updated content, target appropriate information and record statistical info/reports. In addition, smart posters are extremely low cost compared to other forms of electronic displays (NFC Forum 2011, as cited in Boes et al. 2015). Therefore, the ROI can be significant. Sandner et al. (2007 as cited in Boes et al, 2015) argues that because the user is actively asking for information by choice, smart posters could increase the success of mobile marketing. This is due to the advertisements relating to the current situation and therefore is perceived as value by user and not intrusive. Thus, this location-based advertising can lead to revenue.

Borrego-Jaraba et al. (2011) trialled in Cordoba, Spain, smart poster effectiveness. The results were found to be positive and feedback of users emphasised the simplicity of using the NFC posters. Broll et al. (2007 as cited in Boes et al, 2015) discovered in their research of smart ticketing smart posters that participants thought the concept was innovative and enjoyable. Therefore, both example displaying positive and an openness by consumers to use if available. The more that businesses begin to use such posters could potentially aid the acceptance of NFC technology by users more in the future (Boes et al., 2015, p. 437).

Finally, Borrego-Jaraba et al. (2011, p. 736) concluded from their research on touristic Smart posters that the main role of these posters is to:

- *“Allow the user to access the available information and services in a touristic information service, related to (a) the point of interest where the Smart Poster is located and (b) any of the other points of interest or locations showed in the Smart Poster.*
- *Display different options to the user (any different icon/ picture/object listed in the Smart Poster) in order to get information about it, led to it and, therefore, locate it from a Smart Poster placement”.*

Pesonen & Horster (2012, p. 13) noted that several authors have presented NFC applications to utilise social networks. Smart posters are in a position to exploit this possibility by enabling friends to share **current location** by touching nearby NFC tags. Furthermore, NFC phones are able to share contact details

touching the other users' NFC device through the peer-to-peer mode. Ideal for business **conferences** and reducing the need for business cards that could be lost.

Smart poster scenario

NFC tags can be used to provide travellers with information on their location and give directions (location-based services) from current location to the advertised smart poster business, i.e. a clothes store located in the city. Fischer (2009, p. 24 as cited in Pesonen & Horster, 2012, p. 14) gives a good example of this: “The customer sees an advertisement, likes what he/she sees, waves the phone, and orders the product right there. Imagine arriving at an airport, going to a hotel advertisement board, choosing a hotel that looks good, and waving the phone reader over the tag; the phone either offers the URL to go to the reservations Webpage or just dials the number, and stores the address in your phone. You confirm with the hotel. You then go to your rental car and wave the phone over the navigation system for a peer-to-peer connection; the address you got from the board is transferred into the navigation system, and you are on your way”. Even though this example may seem futuristic, technology is already in place to make this a realistic experience for tourists exploring a new destination. Potentially, it has the power to overcome language barriers in addition to the other benefits quoted.

2.8.7. Additional NFC case studies

The following selection of in-depth NFC case study reviews can be found in Appendix 3. These are outlined below:

[Airports: Check-in & advertising](#)

Digital access via NFC enabled devices (check-ins, door access). Paperless travel via APPs/NFC.

[Smart maps](#)

NFC embedded maps offering extra data to POI's.

[Clarion Hotel, Stockholm](#)

NFC check-in/out services, hotel room access via NFC enabled device.

[The City of Nice](#)

Transport information, payment and access system via the use of NFC enabled devices.

[Mobile APP EpicMix at the Vail ski resorts](#)

Lift access and tracking services in skiing resort. Share ski data on social media.

[The Museum of London](#)

SMART museum to enhance experience of cultural heritage. Instant links to rewards and digital content.

[Google field trials](#)

Digital instant information access at POI and NFC payment services in shops/transport.

2.8.8. NFC Considerations for implementation

Tourism destinations are in a position to attain uniqueness and become niche through the realisation of applying NFC, which can also be said for the other Smart Tourism Tools mentioned in this thesis. Therefore, in support (Ronay & Egger, 2013a, p. 574) who state “The implementation of ICTs in cities is the key success factor to encounter the global problems [...] the short range communication technology NFC was identified as one of these ICT technologies which will shape our lives and movements in cities”.

Pesonen & Horster, (2012) argue that NFC for tourism practitioners (stakeholders/businesses) can help improve destination service quality, branding and marketing, especially the use NFC tags and smart posters. Moreover, NFC enables paperless travel and thus potentially making the smartphone all a tourist might need when travelling to technologically advanced destinations. According to Ondrus and Pigneur (2007 as cited in Pesonen & Horster, 2012) access control schemes based on NFC (i.e. digital hotel room keys) are found to be very popular, meaning that smartphones become multi-function. NFC also enables automatic check-in/out in accommodation providers, like the Clarion Hotel in Stockholm. EpicMix demonstrates the link between NFC and social media is possible. This being another reason why NFC will be successful on social media platforms like Facebook, used extensively by consumers and companies.

Even though the number of Smartphones has increased, it can be confirmed that hasn't been until the latest version of iPhone 6 release that consumer acceptance of NFC has been limited until the recent new arrival. In addition, Apple wearables in the anticipated iWatch will further increase the demand for NFC services (Clampet, 2014). Hence, a noticeable increase in opportunities for companies to start using NFC profitably, an example of this is Apple pay points.

Destinations are aware NFC tags and smart posters can be linked to websites and online content which is very expensive for foreign tourists because of the high roaming charges. However, NFC with the ability to track visitor movements without Internet connection and consequently is another reason why it is a good option in tourism for stakeholders to track visitor movements (for example, at events, amusement parks, etc.).

In conclusion, NFC is an excellent way to increase interaction between the tourist and the destination. Smart posters can provide visual opportunities to call to action points and connect with travellers. NFC can also reduce the number of actions a user needs to perform to digitally connect with POI, hence increasing user experience through providing secure and easy ways to share information as well as making technology adoptable to all. For tourism marketers NFC can make it even easier to offer mobile coupons and discounts to attractions.

Hypothetically, NFC could be one of the technological developments that changes the way travellers search for information in the future where tourists are provided with constant real-time travel information. Besides, NFC technology helps to connect objects to information resources on the Internet and aids in the growing development of IoT. NFC will also serve as an enabler to access services like the augmented reality stated earlier and generate overlaid world of information.

“Adopting NFC technologies is a step towards paperless travel, meaning that tourists will need only to carry a mobile device with them [...] It is clear that NFC technology holds great promise for tourism industry” (Pesonen & Horster, 2012, p. 16).

2.9. Understanding the Digital Tourist

2.9.1. *User profile*

There is yet to be any specific research on profiling users of *SMART Tourism Tools*. To try and understand the possible users of these *SMART Tourism Tools* at destinations, the following authors have been referred to due to the nearest relevance to the subject of this paper, the following has allowed an insight into the possible traits related. However, *SMART Tourism Tools* are available to all who visit a destination, though for obvious reasons this would be the more technologically aware users who feel more comfortable in using the Smart tools. Therefore, the following extends on the previously discussed **Generation Y: NET Generation** set out in the background introduction (page 3). This section highlights the trends in current/future markets and thus re-enforces the need for destinations to anticipate the demands of evolving markets.

“A survey conducted by TNS Global (2008) indicated that many see the internet as ‘an encyclopaedia of information’, where three out of the top five activities engaged by online users are related to information gathering [...] within the tourism industry, the internet is being targeted to become the most important channel for holiday sales, information and recommendation where two out of five reservations are completed online and 55% of all European travellers use the internet for information about their travel destination, travel providers and special offers” (Isabel, 2009 as cited in Yeoman & Yu, 2012, p. 66). This clearly shows that the tourist link with the internet in the pre-travel phase is high. In addition, as previously stated that the on-site relationship that tourists have with mobile information searching is also of significance to destinations. This pre and during travel experience online means destinations have multiple contact points to engage with consumers. In this, destinations have the ability to influence tourist decisions through their online activities, i.e. *SMART Tourism Tools* on-site.

2.9.2. *SMART User Characteristics*

Additionally, Buhalis & Amaranggana (2013, p. 560) in their study of *SMART Tourism Destinations* have formulated a list of characteristics to better define the technologically savvy tourists. They are:

- Well-connected and well-informed,
- Active critics and buzz marketers,
- Demand highly personalised service,
- Engaged both socially and technologically,
- Dynamically discuss through social media,
- Co-create experience,
- Contribute to content,
- Utilise end-user devices in multiple touch-points.

These points provide a better depth to the potential users of *SMART Tourism Tools*. Moreover, the previous demonstrates that there is an active market available that are ready to use *SMART Tourism Tools* via their

own devices. It therefore seems logical that these on-site tourism tools should be readily available to willing participants. Moreover, destinations who better understand their market are in a better position to satisfy their needs and meet expectations.

2.10. Summary of literature

In summary, this literature review has highlighted the link between the *SMART Planet* concepts through to the tourism aspect of *SMART Tourism Tools* within touristic SMART environments. This paper has provided a necessary in-depth insight into the highly complex, interwoven and complicated platforms that are required for any *SMART Tourism Tools* to exist. Furthermore, there is a clear need on both sides of supply and demand for the use of SMART Tools within tourism destinations. In this, the destination and tourist can both benefit greatly from the use of SMART Tourism Tools.

Therefore, this thesis provides the knowledge platform for stakeholders to make informed decisions in relation to new technologies within tourist consumer use. Furthermore, the literature here forms a basis for the conceptual framework later discussed. It is the aim of this framework to demonstrate and visualise the link between technology and the touristic resources of a destination.

As stated, this paper seeks to fill the research gap by identifying opportunities and challenges as well as conceptualising a framework for *SMART Tourism Tools* towards enhancing destination competitiveness. Consequently, this framework could be applied to all SMART destinations, however, destinations will be able to view different aspects of the framework that match their products and align with the appropriate *SMART Tourism Tools*.

Moreover, an addition of such a framework has the potential to aid and influence developments in providing the new and exciting products for tourists to enjoy while visiting their SMART destination. These products can offer tourism information, time-saving applications and more. Additionally, these SMART products have the potential to improve destination image whilst promoting the pre-existing tourism products. Thus, in doing so cities will be in tune with the market trends and staying incredibly competitive in the tourist urban destination choice.

3. Methodology

In order to gain effective results, this thesis has a combination of secondary and primary research methods. Secondary research consists of a thorough and in-depth review of literature. Due to the newness of the subject, only a fraction of what is possible is yet to be put into consumer use. Therefore, much of the information found in literature may have only been used or trialled in certain areas of the globe and hence the need to gain a collective overview of what is known about SMART Tourism Tools has been sort. In regards to Primary research, Semi-Structured interviews have been conducted with professionals within a variety of relevant fields linked to technology and tourism. The below outlines the Secondary and Primary research methods:

3.2. Secondary Research

“A researcher cannot perform significant research without first understanding the literature in the field.

Not understanding the prior research clearly puts a researcher at a disadvantage”

(Boote & Beile, 2005, p. 3)

As stated, a literature review has been conducted predominately of academic articles, journals and books. At times, technology and future tourism websites were consulted in order to gain definitions. It was deemed necessary to make a thorough overview of literature and present within this thesis to re-enforce the foundations and arguments made. Further, the newness of the subject needs to be highlighted in order for the reader to gain new perspectives of the technological world and the new challenges tourism is facing. It is aimed that this thesis could be picked up by any person and enlightened to the possibilities of current and future tourism trends. In addition, it is designed to inspire destinations who have increased knowledge of tourism technology. In addition, the benefits of implementing tourism technology are put forward and the rewards that destinations can receive beyond the fiscal to enhance both location and tourist experience.

3.3. Primary Research:

Semi-structured interviews have been conducted for the role of primary research. Interviews have been sort with professionals, educators, researchers and industry leaders within the tourism and technology field. It is argued that this form of qualitative method is highly beneficial for gaining information on the chosen topics whilst allowing freedom to investigate new and previously unknown areas. Furthermore, due to the emerging technologies and new innovations, little is known or appreciated about the subjects on a large scale. Therefore, this research has had to seek out a smaller sample size of knowledgeable persons to gain effective results. In defence of this, Rowley (2012, p. 261) brings forward that “the researcher is interested in collecting facts, or gaining insights into or understanding of opinions, attitudes, experiences, processes, behaviours, or predictions” to which conducting qualitative research like interviews enables this.

3.3.1. Semi-structured interviews

Bryman, (2012) contends that semi-structured interviews allow a degree of structure in an in-depth interview situation, but also enable the possibility to respond to what seems to be noteworthy responses. Furthermore, semi-structured interviews “typically refers to a context in which the interviewer has a series of questions that are in general form of an interview schedule but is able to vary the sequence of questions. The questions are frequently somewhat more general in their frame of reference from that typically found in a structured interview schedule” (Bryman, 2012, p. 212). Additionally, Harris & Brown (2010, p. 1) state that “interviewers begin with a small set of open-ended questions, but spend considerable time probing participant responses, encouraging them to provide detail and clarification; these data are generally analysed qualitatively”. Thus, highlighting this form of interviewing is flexible but also directive to achieve the desired context.

Rowley's (2012, p. 262) work on helping students to interviewing methods also notes that “for a novice researcher” (and agrees with the previous authors) a semi-structured interview is “based on an interview schedule” but goes further by stating that it focuses “on around six to 12 well-chosen and well-phrased questions to be delivered mostly in a set order, but with some flexibility in the questions asked, the extent of probing, and question order, is a good starting point. Each question may have two to four sub-questions or prompts, which are used by the interviewer if they are necessary to ensure that the interviewee explores the main question sufficiently”.

Analysis of data

The analysis of results will be constructed from a mixture of Grounded theory coding along with a selection of quality quotes. In this, re-current comments will be identified, grouped and "themed". This process is called coding. The grounded theory highlights key terms in interviews and codes them under the theme they represent. Once an interview is de-coded (a process of picking out key issues), the final codes can lead to a conclusion on the overall direction of where respondents relate on certain topics. Thus, support and highlight key trends which lead to the outcome of results in the discussion chapter.

3.3.2. Summary of Questions:

The following displays the themed questions that each participant was asked during the Semi-Structured interviews. Questions were altered depending on the interviewee background and knowledge. *A detailed review of questions and answers can be found in Appendix 4.*

- Innovation in tourism for touristic use (Definition/Examples)
- Applications in tourism (Definition/Examples)
- Augmented Reality in tourism (Definition/Examples)
- NFC in Tourism (Definition/Examples)
- SMART Cities and tourism (Examples)
- Word association: SMART Tourism Tools
- Additional comments on subjects discussed

3.3.3. Participants of Semi-Structured Interviews

Participants were chosen based on their educational and professional experiences with the relevant subjects linked to this research. In order to obtain a variety of different opinions, individuals from many different fields were approached, such as students, doctorates, lecturers and industry leaders. A *background summary of each participant can be found in Appendix 4*. The following table (7) details the chosen interviewees:

Name (who)	Position (What)	Company (where)	Contact details	Interview DATE (When)	How
<i>Jim Hendriks</i>	NHTV student AR/APP Specialist	NHTV IGAD 2 nd Year	LinkedIn: http://goo.gl/RH0Lj https://www.facebook.com/jim.hendriks.39?fref=ts	Wednesday 1 st April 12:30pm	Face2face
<i>Katerina Volchek</i>	PHD Researcher AR Specialist. Tourism	Bournemouth University	LinkedIn: http://goo.gl/ciEacv https://www.facebook.com/katerina.volchek	Friday 3 rd April 7:30pm	Skype
<i>Rachel Meer</i>	NHTV Student: AR Specialist	NHTV IGAD 4 th Year	LinkedIn: http://goo.gl/3Yslcx rvdm88@gmail.com	Monday 6 th April 8:00pm	Telephone
<i>Marc Thalen</i>	NHTV Student: NFC Specialist	NHTV IGAD 3 rd Year	LinkedIn: http://goo.gl/KpCjZw https://www.facebook.com/marc.thalen	Thursday 9 th April 12:00pm	Face2face
<i>Oliver Davies</i>	Lecturer: Innovation Specialist	NHTV IGAD & Innovation	LinkedIn: http://goo.gl/IDYdFG davies.o@nhtv.nl	Wednesday 8 th April 13:00pm	Telephone
<i>Kim Boes</i>	PHD researcher NFC Specialist. Tourism	Bournemouth University	LinkedIn: http://goo.gl/GO5WpE kboes@bournemouth.ac.uk	Thursday 9 th April 1:30pm	Skype
<i>Marjolein Visser</i>	Lecturer/Digital Consultant	NHTV e-commerce	LinkedIn: http://goo.gl/J5D89h info@market-wise.nl	Monday 13 th April 2:30pm.	Face2face
<i>Tomas van der Plaetse:</i>	Online Marketing Con. Tourism Spec.	Independent expert	LinkedIn: http://goo.gl/A90W6Z tomas.vanderplaetse@gmail.com	Monday 27 th April 11:30am	Skype

Table 7: Details of interview participants.

3.4. Limitations

As previously stated, it must further be noted that this subject is highly new within the field of tourism. Therefore, an extensive review of literature has been sort in order to lay the foundations for arguments. Furthermore, a selection of interviewees from various backgrounds have been approached due to the broadness of the SMART Tourism Tool concept. This concept contains many different aspects to be able to function and exist. In addition, many destinations have been reviewed and their technological aspects assessed in order to gain an overview. Lastly, at time interviews were conducted via telephone/Skype to gain international perspectives from experts.

4. Results

The following brings forth the results gained through semi-structured interviewing. The interviews were conducted with leading professionals within the relevant field, these included leading PHD researchers, industry professionals, lecturers and technology students. *A summary of questions and answers can be found in Appendix 4.* The results are presented under headings that were formed on the basis of questioning. These topics link with the purpose of this thesis. After the results, a Discussion (*Chapter 5*) of findings based on the secondary and primary research has been conducted. *Notably, these results will be placed into further context in Chapter 5 through theming.*

Throughout the interviews, participants were asked to provide their own definitions on particular SMART tourism concepts: SMART Cities, SMARTness, Applications, Augmented Reality, and NFC. Answers have been coded in order to reach these tourism related definitions. Further, the role of these concepts in tourism is explored. Additionally, Quotations and statements are frequently provided, at times these were either shared opinions or uniquely provided in Personal Communication (p.c.).

It can be said that the results section is highly extensive, however, many valuable and previously unconsidered insights are set forward. In this, readers looking to make SMART decisions to implement such SMART Tourism Tools will find these professional opinions vital.

4.1. SMART Cities and Tourism

O. Davies (personal communication (p.c.), April 8, 2015) describes SMART cities as a trend, in this, there is **“move towards cities that are increasingly managed and based upon digital technology”**. Furthermore, SMART Cities exist within areas of **“Large urban cultivations”** and thus are where the **improvements and efficiencies are needed** most (O. Davies, p.c., April 8, 2015). However, **“eventually everywhere will be SMART”** and in the **long term, even tourist destinations outside of cities will allow these types of technologies and solutions** in the future (O. Davies, p.c., April 8, 2015). Though in the short term, **major areas generally lead the way** in SMART technologies as the infrastructure is already established (O. Davies, p.c., April 8, 2015). M. Visser (p.c., April 13, 2015) proposed that it is **SMART companies that make SMART cities** based on many **different ideas to form a community of SMARTness**. Thus **helping cities to make the right and good choices**. Although, O. Davies (p.c., April 8, 2015) highlights that **“we’ve seen already a number of industries are being disrupted by technology”** as can be seen by the introduction of companies like **“UBER” transportation** and **“AIRbnb” accommodation**.

Interviewees also offered several examples of SMART Cities:

- **Vancouver:** has the **“V-POLE”** where anyone can approach the pole in the middle of the city to gain **free Wi-Fi** and links to useful apps. This simple product within a touristic city **offers a lot of value and brings people together**. Moreover, offering functionality (T. Plaetse, p.c., April 27, 2015). T. Plaetse (p.c., April 27, 2015) adds to this that **“Cities clearly understand that they should provide Wi-Fi everywhere because if you have it people will be sharing your destination, it’s the wisest thing to do first”**.
- **Dublin:** Guinness brewery **“Augmented Reality tour”**. **No application required** links directly to the facility **free Wi-Fi** at attraction and therefore **no roaming fees** even though a **Web Based app**. AR provides a **digital visualisation** to the process of beer in production, in essence **x-ray vision** through pipes via smartphone. Even though a beta project, it has positive reviews (J. Hendriks, p.c., April 1, 2015).

- **Barcelona and Amsterdam:** are not focusing on tourism. In this, they have many ways of monitoring and gaining informed decisions to be more sustainable (K. Boes, p.c., April 9, 2015) like **controlling mass tourism** indirectly.

SMART Tourism Destinations

T. Plaetse (p.c., April 27, 2015) states that SMART Cities are “**Broader than tourism alone**”, therefore, K. Boes (p.c., April 9, 2015) brings this into tourism context with “**SMART Tourism Destinations**”.

K. Boes (p.c., April 9, 2015), a professional in the field of SMART Tourism Destinations, explains that “**the problem is we don’t have any SMART Tourism Destinations, we have smart cities at the moment**”. In order “**to be able to be a smart tourism destination, you have to be a smart place, you have to be a SMART city, because it’s more than only tourism**” (K. Boes p.c., April 9, 2015).

SMART is just a **BUZZ word**, to be a SMART Tourism Destination, many layers are required where the focus is not just on technology. In this, **SMART thinking is crucial** and not just being reliant on tech (K. Boes p.c., April 9, 2015).

Which leads to SMARTness:

K. Boes (p.c., April 9, 2015) points out that “**the world population is growing and with that we put more pressure on our environment, and with technologies we can better see what is going on and better make better solutions for problems that we have**”.

For example, **SMARTness can resolve Mass tourism**. It can help **control high numbers** and **see what’s going on** and **to make better decisions** (K. Boes, M. Visser, p.c., April, 2015). This is based on the **data collected** through **tracking and exchange information** between tourist and destination (K. Volchek, p.c., April 3, 2015).

K. Boes (p.c., April 9, 2015) states that when a destination considers implementing SMARTness, it should ask itself the following: “**How should we imply smartness, what will this bring, and how will it increase competitive advantage**”. In conclusion, you must define what it is to be SMART beyond the technical aspects and recognise the concepts of “**Soft SMARTness and Hard SMARTness**” (K. Boes p.c., April 9, 2015).

- Soft SMARTness: **collaboration, innovation, leadership**
- Hard SMARTness: **Technology and infrastructure** (Heart of SMARTness)

These Smart concepts are “**Very important to be able to become a SMART Tourism Destination**” and therefore, SMART Cities consist a layer of soft smartness and hard smartness (K. Boes p.c., April 9, 2015).

In summary, this section clarifies the SMART concept further by bringing forth that technologies are highly beneficial to cities. However, a crucial aspect of SMARTness is also required in human capital through innovative ideas and effective leadership working in tandem with tech to make SMARTer decisions.

4.2. SMART Concepts and Innovations

Big Data

SMART Cities offer the infrastructure needed to **collect Big Data**. This data collection occurs through **imbedded sensors in the environment** (K. Volchek, p.c., April 3, 2015). Tracking information between tourist and destination can be used to **improve services** and “**identify a tourist from a social and economic group you can offer exact services they are looking for**” (K. Volchek, p.c., April 3, 2015). Also, the gathering data can benefit residents, for example, **deal with traffic jams** (K. Volchek, p.c., April 3, 2015) and provide “**Real-time**” information (M. Visser, p.c., April 13, 2015).

Co-Creation

Data can lead to **Co-creation: it is important that tourists are part of their product** (K. Boes, p.c., April 9, 2015). **Technologies lead to better communication**, not just **between the stakeholders and the tourists** but **between the tourists and the residents** also (O. Davies, K. Boes, p.c., April, 2015). **“Smart cities can help people to work together through better communication and understanding, thus improve the lives of those who live at the destination”**, this can then also **increase the tourist experience** (K. Boes, K, Volchek, p.c., April, 2015).

Digital Tourists

T. Plaetse (p.c., April 27, 2015) discusses the characteristics of the **“Digital Tourist”** who are **“using their phones for everything** you can imagine: **Booking and finding information** in the destination itself”. Unlike planning well before the travel begins, bookings and information searching is now conducted **“closer to the actual travel so mobile becomes more and more important”** which means **“sites like TripAdvisor and yelp are very relevant and used”** (M. Visser, T. Plaetse, p.c., April, 2015). **“For digital tourist these tools are a no brainer!”** (T. Plaetse, p.c., April 27, 2015).

For Digital Tourists, **more experience content** (i.e. spotted by locals) gives information on POI's and opportunities to enhance experience. Also, **Storytelling** improves the tourism experience in an interesting way (M. Visser, T. Plaetse, p.c., April, 2015) through **digital guides** and **Video blogging**. Offering **“Richer content”** through technology **encourages people to share it** which is superior for a destinations when content is **“User-Generated”** and not pushed by themselves (T. Plaetse, p.c., April 27, 2015).

However, M. Visser (p.c., April 13, 2015) does point out that even though **intelligent services** are able to provide **automatic preferences**, the downsides could potentially be that **tourists loose the exploration** and become **reliant on services being presented** without researching for themselves.

Implementation & Important Considerations

“Technology moves fast” and **“we have developments all the time”** (M. Visser, K. Boes, p.c., April, 2015). Therefore, **new specific technologies aren't important**, it's the **acceptance** of them (K. Boes, p.c., April 9, 2015). **“What is out there must be easy”** because **“a tourist doesn't want something that is very difficult to use and they don't want new things all the time”** (K. Boes, p.c., April 9, 2015). **Technologies should be seamless** and not seen. People don't want to feel like they are being looked on /spied on all the time (K. Boes, K. Volchek, M. Visser, p.c., April, 2015). And importantly **“tourists shouldn't be pushed to use a certain technology”** (K. Boes, p.c., April 9, 2015).

Advice for Destination Stakeholders

From an industry perspective, one interviewee was able to comment on implementation factors of ICTs in destinations. T. Plaetse (p.c., April 27, 2015) declared that destinations should **always remember why they are building something**. The goal should be **“How to get the visitor while at the destination and how you can use them to improve experience by offering the right tools at the right time. Some destinations forget this”** (T. Plaetse, p.c., April 27, 2015). By this, there should not only be a focus on the inspirational phase of travel but it is important to also remember the actual travel phase to connect with the visitor while on-site (T. Plaetse p.c., April 27, 2015).

M. Visser (p.c., April 13, 2015) stated the problem with technology is that it is changing so fast and hard to keep up with. Therefore, investments are expensive and making the right choices is crucial to staying up to date. Furthermore, from a consulting perspective, pushing ICT is necessary in order for “tourism businesses and the people involved to be forced into the new world”, it can difficult to bring new ideas to some businesses where they are slow to react. Only when they see it happening they generally act too late (M. Visser, p.c., April 13, 2015).

In summary, this section highlights the rewards in collecting Big Data and the ability to deal with issues efficiently. Moreover, an insight into key considerations when implementing tourism technology that can ensure added value for tourists and their acceptance of new tools. Also, increased communication platforms between all parties enables co-creation of experience.

4.3. Applications

Based on the answers, coding has led to a definition of an Application as:

A Small piece of software that enables a specific goal to be achieved through the exchange of information.

During one interview, R. Meer (p.c., April 6, 2015) brought forward the concept “**Toolbox**”, where the smartphone (hardware) could be considered as the holder of many “**Tools**” (applications/software). “One piece of hardware can run many different applications that fulfil many different roles, like a tourist information, medical tools, etc. the **Tool** would be the individual app”. Once again, linking back to previous arguments made in literature.

Role in tourism

In destinations, applications can provide a varied range of services. However, as interviewees support, applications used in the **on-site phase** predominately provides **information** (J. Hendriks, K. Volchek, R. Meer, O. Davies, M. Visser p.c., April, 2015). This information can then be used by tourists to **make choices**. For example, making reservations, finding directions, choosing local amenities, translation of menus, etc. (J. Hendriks, K. Volchek, R. Meer, O. Davies, M. Visser p.c., April, 2015). In addition, applications allow **Real-time communication** between stakeholders and customers (K. Volchek, p.c., April 3, 2015). M. Visser (p.c., April 13, 2015) notably points out the usefulness of applications in **cultural heritage** where they can provide **audio guidance** in addition to more information.

Significantly, two interviewees point out that “**Data is important, not the application**”, the app is just a platform that offers the ability to provide information (M. Visser p.c., April 13, 2015). This data should always remain up to date and relevant (M. Visser, K. Boes p.c., April, 2015). T. Plaetse, (p.c., April 27, 2015) also re-affirms previously reviewed literature where “**Native apps allow you to do things offline**” and “**Web apps are linked to online**”.

As the data is mentioned to be more important, a recommendation to be successful when creating new apps for a destination is to focus on a “**Niche marketing approach**” (T. Plaetse, p.c., April 27, 2015). In this, trying to satisfy a small sector of a destination rather than filling an app with everything and doing it badly. T. Plaetse (p.c., April 27, 2015) states “**it’s better to think ‘niche-niches’ than to say we have all this data we should just dump it in a mobile app because that’s not going to work**”. For example, the “**Flanders promotional app: Beer app**” (niche marketing) focuses on this Niche subject and provides the best information possible working with all local stakeholders in that field (T. Plaetse, p.c., April 27, 2015).

Further to implementation, T. Plaetse (p.c., April 27, 2015) advises “**Destinations should work on their strategic partnerships with companies**” to build niche apps and entice them to create good content, i.e. beer app and working closely with the breweries. This is because creating your own app is too time consuming: “**developing, maintaining, slow process, complex and costly**” (T. Plaetse p.c., April 27, 2015). Therefore, it is advised to **utilise 3rd party platforms already established and entice others parties to use your data/content**, for example, **Booking.com does it better than creating your own destination app promoting accommodation** (T. Plaetse p.c., April 27, 2015).

Example recommended 3rd party application platforms are (T. Plaetse p.c., April 27, 2015):

- OJOO (“**Gamify your world**”): **create own content and stories of travel to share with others**. It is a **City guide with a difference created** on 3rd party software by the developers for the destination. Not just the normal attractions but themed (example, street art locations). Can be implemented by the destination and open for residents/visitors to create routes and notable sites.
- KRUMB (**location-based app**): publishers of content can hide it within a destination map. This is Gamification by hiding treasure around the city and **increase customer experience**. Participants go around the city looking for “**Breadcrumbs**” of interesting content and has already been utilized by the Belgium city of Brussels. Treasure hunting content there has been very positive (T. Plaetse p.c., April 27, 2015).

These 3rd party apps re-enforce the previous arguments against destinations building their own apps and supports realization that the process to do so is very complicated.

In summary, this section has brought forward key points for destinations to consider when implementing applications. In this, the utilisation of 3rd party applications can be far more effective combined with the destinations own content rather than building a new tool from the start (i.e. development, cost, etc...).

4.4. *Augmented Reality*

Interviewees were asked to give a brief definition on Augmented Reality. The following is based on their joint coded answers given:

Augmented Reality is an overlay of information on top of the surrounding real-world environment to provide additional data on a current position. A device with a digital screen is required in order to superimpose this artificial layer of information, such as a smartphone or lens system (i.e. Google Glass).

Role in tourism

In a recurring theme, AR plays a role well in **Cultural Heritage** (J. Hendriks, K. Volchek, p.c., April, 2015). An example by J. Hendriks (p.c., April 1, 2015) highlights this in the use of AR at a **Roman theatre** where the user can point their phone at arena and see a gladiator fight, in essence “**see old times**” and “**rebuild something destroyed**” digitally (J. Hendriks, M. Visser, p.c., April, 2015). As M. Visser (p.c., April 13, 2015) states, “**AR is digital support for what you really see**” including how we can **see how things used to be**. Even in more recent history, O. Davies (p.c., April 8, 2015) brings this context forward in mentioning the “**Berlin Wall**” and how it can be “**superimposed and see how the city once was**” on a smartphone. Furthermore, AR allows us to “**see changes**” (O. Davies, p.c., April 8, 2015).

In addition to Cultural Heritage, AR can “**Guide us**” and “**offer POIs**” (O. Davies, p.c., April 8, 2015) within applications like “**Google maps**” offering “**Location-based services**” (R. Meer, p.c., April 6, 2015). In the

pre-travel phase, Marriot Hotels have considered the technology to even **“inspire customers to visit”** (K. Volchek, p.c., April 3, 2015).

In terms of AR platforms to allow destination to consider implementing this visual tool, O. Davies and T. Plaetse (p.c., April, 2015) both recognise the Dutch company **“LAYAR”**. This 3rd party allows businesses to send its data to them where they will create the desired application, as for example with the **Flanders Tourism Board** (T. Plaetse p.c., April 27, 2015). In doing so, reduces the strain on destinations to create and manage, thus reducing the **financial burden** (T. Plaetse p.c., April 27, 2015). Clearly supported by K. Volchek (p.c., April 3, 2015) commenting how it is **difficult for big business to gain ROI on AR** implementation. Therefore, It is **recommended smaller companies utilizing other 3rd part APPs** like google maps, TripAdvisor, etc. for **small companies whom are unable create something for themselves** can use similar services to benefit their own company (K. Volchek, p.c., April 3, 2015).

Noteworthy examples of specific AR applications were given by T. Plaetse (p.c., April 27, 2015), **“LAPIFICATION”**: allows users to experience the Northern Lights anywhere in the world and thus created a positively **“massive PR”** campaign for the brand Lapland. Users could hold up their device and using the AR app could see a virtual **“Northern Light show”**. A clear demonstration of AR working for a destination outside of the destination. T. Plaetse (p.c., April 27, 2015) also discussed **“Visit Norway: Oslo”** app, (also competing for Northern Light tourists) however, for the **“on-site Phase”** that provided the necessary information to gain the best views (where and when to see). Offering and encouraging a **“Better customer experience”** and promoting the **“strengths and brand”** of Norway.

Benefits

Beyond the usual beneficial points, AR brings the next. In this, AR **“provides people with great experiences”** and **makes life more easier/convenient** (K. Volchek, p.c., April 3, 2015). Tourists want a **“unique experience which is how companies can now compete”** (K. Volchek, p.c., April 3, 2015), and thus **creating an attractive city** with new ICTS (M. Visser, p.c., April 13, 2015).

Businesses can use **ICTs** to **create something unique for clients** showing them what that can receive on-site (K. Volchek, p.c., April 3, 2015). Moreover, destinations can benefit by offering points of information in a new way that gives a uniqueness of that destination therefore, providing **“a more complete experience”** and **“showing tourists a story”** (M. Visser, p.c., April 13, 2015). K. Volchek (p.c., April 3, 2015) states from her research that AR has a **“great future and offers unique value”** as it **“enables co-creation”** as **tourists want to participate in the creation of experiences**, AR enables this.

K. Boes (p.c., April 9, 2015) rounds this off well in stating that AR **“can be used with anything and in tourism it is very nice to have”**, meaning the extra services for touristic use.

Key considerations for AR implementation

K. Volchek (p.c., April 3, 2015) argues that **if AR becomes too good then people could skip aspects of their trip**, and thus not visit some attractions due to already experiencing on their smartphone. Further, **ICTs should not be forced on tourists and should remain seamless/invisible for tourists** to use and prevent, for example, a **“Disney’fied ROME experience”** (M. Visser p.c., April 13, 2015). For companies, **to ensure the success** of applications and AR in their destination, **it is crucial that these services are promoted and fulfil tourist needs** (T. Plaetse, p.c., April 27, 2015).

Wearables: hand in hand with AR

A recurring topic on AR was wearable technology or otherwise known as “Wearables” (T. Plaetse, K. Volchek, R. Meer, K. Boes, O. Davies, p.c., April, 2015).

Obviously, an issue with smartphone AR is that the device must always be held in order to view contents (K. Boes, T. Plaetse, p.c., April, 2015) meaning that **wearables would be more convenient** (K. Boes, p.c., April 9, 2015). Possibly options would be “Lens Systems” (O. Davies, p.c., April 8, 2015) such as “**Google Glass**” and “**HOLO lens by Microsoft**” (K. Volchek, R. Meer, p.c., April, 2015). Although, T. Plaetse (p.c., April 27, 2015) felt this was an **expensive technology and overhyped** in his opinion.

In summary, this technology can enable destinations to create unique experience for tourists, especially when applied to Cultural Heritage. Furthermore, there is an importance for co-creation and allowing tourists to be a part of their product. Additionally, technologies should remain seamless, therefore convenient and natural in the tourist’s use. Lastly, wearables are on the rise and recognition of this is notable.

4.5. NFC

The interviews also enabled a deeper insight into NFC. This feedback led to the following coded definition:

NFC is short range wireless radio communication protocol that can function between a tag/chip that transmits data stored on it to an electrical device that read/receive the data. Further, NFC can be used to communicate between different devices without the need for configuration, for example, between two different smartphones/tablets pressed very closely together to send very small amounts of data like a picture or share information like contact details without the need for authorization/passwords.

Role in tourism

R. Meer (p.c., April 6, 2015) states that NFC can be used “**at tourist places like museums where tourists can scan information points at paintings/sculptures/historical artefact and then their phone allows it to provide voice communication, for example translation in their native language for instance**”. This was also supported as a viable use of NFC by O. Davies (p.c., April 8, 2015) re-enforcing the need for instances to **quickly receive useful pieces of information such as translation**.

M. Thalen (p.c., April 9, 2015), a specialist in NFC, believes NFC is “more useful in **museums**, if there is a work, you can tap your phone on it and you can get information”. Thus bringing another link with **Cultural Heritage**. Also, NFC can be utilized to simplify the hotel experience in using personal NFC devices to gain entrance to rooms, security doors and offer information on local attractions (M. Thalen, p.c., April 9, 2015).

J. Hendriks, (p.c., April 1, 2015) highlights that NFC connector’s (tags) offer information and thus there is no need for tourists to carry a guide book all the time while visiting touristic location. As previously mentioned in literature, the move towards **paperless travel**. Furthermore, **NFC connectors (tags) dotted around the city at tourist locations can provide a Tourism Route through city, offering information at what they are looking at, history/facts, links to apps, and showing the next POI/NFC location of interest to go to** (J. Hendriks, T. Plaetse, p.c., April, 2015). T. Plaetse (p.c., April 27, 2015) argues that NFC “**Can improve experience by providing the right information at that spot**”.

This links in with K. Boes examples in **transportation**. At a train station, an **NFC Smart poster** can be located in view and if a user hovers their phone over the station name, the user would be instantly linked to the train website with their current location pre-loaded. The user would only then have to add their final

destination to gain all the necessary information on the route they intended to take. This offers **convenience** and **accelerates** the access to information needs (K. Boes, p.c., April 9, 2015). Similar to the Smart poster, tourist **Smart Maps** can be imbedded with NFC tags. These Smart maps can allow the tourists to **scan** POI on the map to gain detailed **information on background attractions** on their device, thus **enhance experience**. Previously trialed in Salzburg. Though important to mention, K. Boes (p.c., April 9, 2015) strongly re-affirms that NFC can “**basically be used anywhere**” and potentially go further than already stated.

Acceptance of NFC

In regards to the acceptance of this technology by users, O. Davies (p.c., April 8, 2015) points out that not all phones are capable of NFC and therefore, the ability for tourists to use NFC within destination may be instantly impossible without a compatible NFC device. Though K. Volchek (p.c., April 3, 2015) resolves this problem by explaining how some hotels in Korea give smartphones to clients during their period of staying, providing smartphone function, free internet and calls. This not only gives the customer **extra value** but also the ability for the hoteliers to **analysis visitor behavior**.

From the perspective of K. Boes (p.c., April 9, 2015), NFC is “**Not being appreciated enough**” because “**APPLE was not using it**” earlier. Further, the “**APPLE PAY**” system now introduced does not let users use NFC in a normal way and thus APPLE “has being stopping the breakthrough of this technology”. However “it is getting better now and we hope in the future they will just go and accept it” (K. Boes p.c., April 9, 2015).

K. Boes (p.c., April 9, 2015) extends her thoughts on this from experience, to state “**It is a shame that NFC isn’t used more**” and that most consumers just do not know what NFC is. Her attendance as a speaker to conferences over the last 2-3 years has found many people surprised by NFC who had not heard of it before. To improve consumer acceptance, people need to be educated more on NFC and its use in daily life should be increased where it becomes normal. Additionally, “**the industry needs to explain it more to the consumer**” this will improve consumer acceptance (K. Boes p.c., April 9, 2015). The benefits that can be highlighted to the industry is that **NFC is extremely cheap, safer and cannot be manipulated**. Also, it is **more attractive than QR codes** (K. Boes, T. Plaetse, p.c., April, 2015). Moreover, the technology is “**easier to implement now than ever before**” (T. Plaetse, p.c., April 27, 2015).

On the consumer benefits, J. Hendriks and M. Thalen (p.c., April, 2015) make clear that it **can be used offline** and no internet is required which can encourage people to use as connection **cost is eliminated** (no roaming fees). This is due to a pre-loaded app being installed to the device (J. Hendriks, p.c., April 1, 2015) and the NFC tag “**triggers something in the phone and therefore NFC is reliant on DATA**” not internet (M. Thalen, p.c., April 27, 2015).

In summary, this section describes the prominent uses for NFC, notably the ability to access information easily and quickly. In addition, outlined considerations for implementation into surrounding environment and rewards of doing so, for the destination and the tourist. Further, user acceptance is improving due to companies like *APPLE* applying new uses in payment services.

Overall, these 3 stated technologies (APPS/AR/NFC) are in essence able to enhance the tourist experience and in return create competitive destinations through providing added value.

4.6. Word Association

The use of word association exercise on the term ***SMART Tourism Tools*** with interviewees has provided the following statement after coding (see appendix 5):

Smart Tourism Tools are a combination of **mobile hardware, software** and **networks** that enable an **interactivity** between **tourists, stakeholders** and **physical objects**. This **communication** allows tourists access to **personalized services** providing in some cases **real-time information**. The **tracking** and **collection of Data** via these systems enables stakeholders to **manage** destinations **effectively** and **efficiently** when making decisions.

The above new SMART Tourism Tool definition clearly outlines the diverse nature of this concept. It combines the previously mentions SOFT and HARD aspects of SMARTness, crucial moves towards to being successful SMART destinations. Furthermore, the definition also highlights the benefits to both tourist and destination, equally profiting from the rewards of usage beyond the fiscal.

The following pages will discuss the secondary and primary findings.

5. Discussion

The changing role of technology within tourism has been made strongly evident in the findings of this thesis.

5.1. *Established re-current Themes:*

It is argued that several themes have recurred. Through understanding these themes better, it is argued that destinations can be in better position to make SMART decisions when considering the implementation of technology for tourism use. Furthermore, the results of the secondary and primary research has led to the formulation of the below conceptual framework. This framework demonstrates the complex and interrelated nature of the subject. Although, it is recognised by the researcher that this is just the first step to completion and requires further research to establish a credible final framework inclusive of additional and evolving variables.

The themes that follow incorporate many of the various points raised in this thesis. These are: ***Seamless Connectivity, Sharing Economy, Financial, Visual Content, Language, Privacy and Wearables.***

5.1.1. Seamless Connectivity

A digital connection for tourists and for SMART Tourism Tools to function is now vital during the on-site phase at a destination. Tourist's desire access to services online whilst on holiday to make plans, gain real-time information, and to interact with near & distant associates. Even more so now, tourists are able to interact with their environment digitally to enhance their own experience. Although, destinations should be actively providing such services, opportunities to do this and the infrastructure to connect. Moreover, for destinations technologies enable platforms to communicate with visitors and provide additional value, such as free Wi-Fi, information resources, and ease of travel. These extra layers of value can re-enforce a destination's position on the global stage and remain competitive.

As outlined in this research, technologies incorporated into the environment allow seamless connectivity to exist and the Facilitation of Communication. In this, Ubiquitous computing (wireless technologies) in SMART Cities, the development of Internet of Things and NFC support this idea. Personal devices enabled with GPS and navigation APPs allow tourists to be continuously aware of nearby POI and services. Further, opportunities for destinations to track users and gain data ensures the ability to improve services and market touristic resources effectively. And, increasingly important in the modern era is to be able to communicate with the silent traveler who digitally seeks advice.

Finally, seamless connectivity Theme's the interrelated aspects of SMART Tourism Tools where they can function between one another to create something new and thus expand the uses. For example, scanning an NFC smart poster in a museum to be automatically connected to free Wi-Fi and offered digital content within an APP of a nearby artefact seamlessly. Connectivity flows from being offline to save on roaming

charges to being instantly able to access, the likes of, transportation and/or hotel rooms seamlessly in order to enhance the customer experience and provide convenience.

5.1.2. Sharing Economy

SMART technologies enable users to share their own User-Generated Content. For destinations, this can be highly beneficial in not pushing their own content onto consumers. Therefore, destinations should encourage sharing amongst tourists by providing the right platforms like SMART Tourism Tools. Furthermore, co-creation allows tourists to be a part of their product. In this, inspiring travellers in the dream stage can promote destinations and encourage visitation.

The collection and exchange of Data via these outlined technologies enable destinations to make SMARTER decisions that improve services and the well-being of the area. Moreover, the sharing of data from the destination provides tourists with well-informed content on the destination. Not only can destinations and tourists communicate through sharing but also the residents who are strongly impacted by tourism. In addition, destinations can also encourage locals to be actively involved in offering content on SMART Tourism Tool platforms, once again allowing co-creation between the three parties of stakeholders, residents and visitors.

Better communication strengthens the success of SMART destinations where people work together to make informed decisions. Big Data allows destinations to gain a better understanding of what is going on and how services can be improved efficiently and effectively. Once again, the technical advances in SMART cities and Internet of Things is crucial to this collection and transfer of data.

On the user side, applications such as reviews, bookings, social media, etc... permit tourists to share opinion, recommendations, real-time data, advice, etc... to enhance experience. In the on-site phase, SMART Tourism Tools assists this convenience when away from computers.

5.1.3. Financial

For tourists, SMART Tourism Tools allow financial matters to be conducted while abroad conveniently. In this, APPs in bookings, ticketing, exchange rates, banking and even paying for things can be done. E-commerce via APPs is highly popular among tourists and this will only grow stronger in the future.

As discovered, roaming charges are a factor when travelling and therefore free Wi-Fi is desirable, however, destinations like Korea are offering the possibility for tourists to rent Smartphones with in-built tourism guide APPs to avoid heavy connection charges while abroad. Thus, highlighting the steps some destinations are taking to maintain the tourist's connection with the location. Ideal, as most visitors will promote a destination while on holiday in the form of the modern day digital postcard.

Returning back to Big Data, destinations who incorporate the collection and use of this to make SMARTer decisions can save expenditure. This is because services and the destination can be constantly reviewed to make the right choices that could save money as well as gaining ROI. SMARTness is about saving money as much as it is making it.

5.1.4. Visual Content

Obviously, Augmented Reality is based on Visual content that provides the user with informed annotations that can aid and enhance experience. It should also be pointed out that the user in many cases carries a Smartphone in order to access SMART Tourism Tools, therefore, the inbuilt camera enables the user to capture their holiday visually. This means that content is viewed and created by the tourists themselves. As stated before, the user-generated content of travel experiences is documented and shared almost instantly while on-site. It is therefore logical that destinations are in an ideal position to provide the adequate platforms like SMART Tourism Tools to promote this. Destinations should encourage tourists to inspire other tourists through the sharing of Visual Content.

In addition, it has been demonstrated in the research that SMART Tourism Tools can extend the life and/or provide extra value to touristic resources. For example, Augmented Reality applied to museum attractions that come alive digitally to provide storytelling and a new layer of education in entertainment. This is also reflected in the user characteristics and clearly shows a demand for such products.

5.1.5. Language

No longer are the constraints of language barriers when travelling to a foreign location, APPs are now available to offer translations on and offline. Furthermore, Augmented Reality can utilise the camera on smartphones to superimpose translations directly onto the screen, perfect for street signs, menus and all written text. In addition, NFC can work in tandem with APPs to access instant translations. For example, swiping over an attraction information board to be directed to the same text in native language on smartphone.

Translation tools are changing the experience of tourists within destinations and moreover, enhancing the experience by empowering them to understand what is around them. SMART Tourism Tools assist in this process to encourage tourists to venture to new destinations.

5.1.6. Privacy

Considerations must be sought for privacy issues when technology is concerned.

Ensuring the safety of the user is paramount in the successful implementation of SMART Tourism Tools at destinations. Data is valuable and how destinations use personal data to improve services should be dealt with sensitively. Therefore, it is important for destinations to make appropriate actions to securely store data and provide reassurance that personal data is protected. Furthermore, education is also key to the

success of such tools within a destination and users should be aware of their own actions whilst interacting with technologies to avoid malicious content. If visitors do not feel confident in SMART Tourism Tools then it is likely they will be unsuccessful.

Steps to achieve this are to provide data protection protocols like encryption methods in tools, inform users how details will be used, allow opt outs and freedom of not being forced into using services.

Location based APPs and AR sometimes access personal and private data stored on the mobile devices, generally this information is on current location but this is helpful to the tourist by providing relevant and real-time information on their current location to ensure the best services are offered. Tracking of tourists could be viewed as intrusive, however, the data rewards are high and can allow destinations to manage mass tourism if attractions peak at certain times of the day for example.

NFC ensures communication between two devices are secure as they must be in very close proximity to function. Communication is instantly stopped when the devices are moved away from each other. The short range radius of NFC connection increases security as no other device can intercept the communication without being visually noticed.

5.1.7. Wearables

Even though this thesis set out to specifically not focus on wearables, it must be mentioned as a recurring theme that should be considered by future researchers. Wearables can allow tourists to travel hands-free without a smartphone in their hand all the time to access SMART Tourism Tools. This can be especially considered when using Augmented Reality as several interviewees and literature pointed out. Additionally, new smartwatches have the capability to conduct purchases without physical money but are reliant on aspects of SMART Tourism Tools to function. Potentially, this technology could be used as attraction admittance and therefore, future research may want to consider the impact this has on tourism experience and new level of connectivity involved. With the push of APPLE products in this category it is inevitable that tourism will be greatly impacted by these trends in the near future.

5.1.8. In summary

Clearly set out above are 7 strong themes that have been presented throughout this thesis. They are designed to aid tourism managers of destinations to fully appreciate the considerations that SMART Tourism Tools have when applied to touristic resources.

The following page (59) brings forth the conceptual framework to this chapter.

5.2. Conceptual Framework: “The Interrelated Triangle of SMART Tourism Tools”

The following conceptual framework titled “The Interrelated Triangle of SMART Tourism Tools”, combines findings from secondary and primary research. Most notably, Buhalis’ (2000, as cited in Buhalis et al., 2013) 6 A’s framework of tourism destinations and Badita’s (2013) framework on Multifunctional character of Touristic Cities.

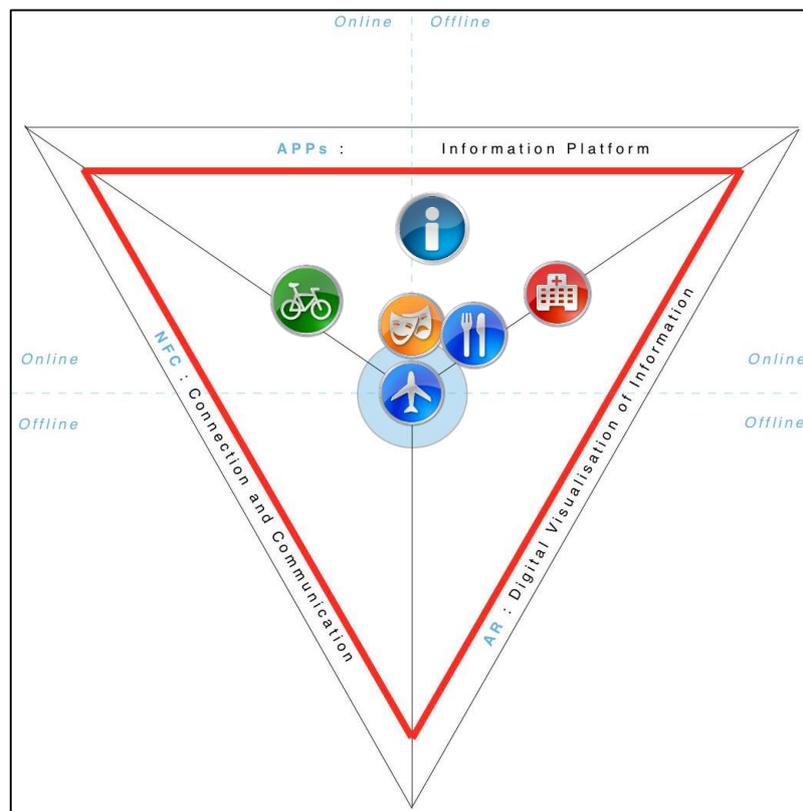


Figure 4: The Interrelated Triangle of SMART Tourism Tools (Smith, 2015)

Key:

Symbol	Reference to 6 A’s of tourism destinations (Buhalis, 2000 as cited in Buhalis et al., 2013)	
	Attractions: natural, cultural, etc...	 Available Packages: Information services, etc...
	Accessibility: public transport, airports, etc...	 Activities
	Amenities: Restaurants, Hotels, etc...	 Ancillary Services: Hospitals, banks, etc...

Table 8: Symbols for the 6 A’s of Tourism Destinations.

5.2.1. Explanation

The triangle represents the interrelated connection these stated SMART Tourism Tools have. In this, they are displayed as individual items but closely linked and can be utilized by one another if necessary. Applications have specifically been positioned above to demonstrate the umbrella that at times AR and NFC are required to function under to provide a platform (application) to operate from.

The red line positioned on the inner main triangle emphasizes the existence of these technologies (APPs/NFC/AR) inside and outside of the tourism context of a “Touristic City” (Badita, 2013). Thus, defining that SMART Tourism Tools can position themselves within many characteristics of the Touristic City (Historic, Cultural, Night Life and Shopping).

In addition, divisions have also been placed (blue dashed line) in order to show SMART Tourism Tools functioning on and offline. This is important in the travel context due to roaming charges and convenience to gain access to information in an unfamiliar location without connection. Lastly, the blue central circle represents the link that can exist between the different technologies, the closer to the center the closer the relationship for that tools and touristic resource usability.

The 6’s of Tourism Destination by Buhalis (2000) integrated into the framework represent the different areas that can be considered as distinctive parts that form the tourism destination. Symbols are represented by: Attractions, Accessibility, Amenities, Available Packages, Activities and Ancillary Services (*see table 8. Pg. 58*). This use of the symbols visualize the link between SMART Tourism Tools and the touristic resources of a destination. It is desired that the framework clearly displays the positioning and the reader can simply ascertain where the SMART Tourism Tools fit within their destination. Further, the on/offline attributes and the use that tool provides.

For example, the Available packages symbol in this case could represent a Tourist Guide APP. Therefore, its position shows that this is offline which is important for tourists wanting to gain local information without internet connection.

Another example, the Accessibility symbol position in the middle reflects the diverse usability of the tool. It can be used to access transportation via NFC, provide navigation via AR and/or provide information on/offline via an APP.

It is important to emphasize that conceptual framework requires further research and evolution to support the SMART Tourism Tool concept. However, the Framework does lay the fundamental foundation for future research and progression.

5.3. SMART Tourism Tools: Future thoughts

The future vision of cities is truly set on the *SMART concept* (Ronay & Egger, 2013a, p. 576). Its notions are developed in order to find solutions for issues on population, urbanisation and the sustainability of urban environments. The implementation of *ICT* in cities is the strategic success factor to meet global problems and along with the technology of *IoT* they will continue to be the long term answer. The future is undoubtedly going to be *SMART*.

Most of the time, tourists only have limited knowledge and low awareness on destinations they visit, they have different needs and characteristics. Thus, implementing the adequate *SMART Tourism Tools* is crucial for satisfying their needs whilst future proofing a destination. In addition to providing for the tourists, the *SMART city* initiatives implemented can also benefit the city residents. Therefore, investments in these types of projects are completely viable.

While a majority of the previous research discuss ideal images of *SMART City* concept, only a few authors have tackled *SMART Tourism Destinations*, being predominantly Buhalis and Amaranggana. They are pioneers in the *SMART Tourism Destination* thinking and are currently an important source. This is only due to the fact that this topic of *SMART Tourism Destinations* is still in its infancy of tourism and little else has been published. However, even though they have set out to define these new *SMART* destinations, lacking in their work and others, is the outline of what exactly *SMART Tourism Tools* are and how to appropriately link them to the relevant touristic resources of destinations. It is believed that this thesis is a move towards new understanding of this little known subject.

It is the final goal of this thesis that the foundations have been laid down and to initiate the next steps forward for future researchers to explore this vast, diverse and exciting concept of SMART Tourism Tools further.

6. Conclusion & Recommendations

6.1. Conclusion

The research goal of this thesis was to understand the concept of SMART Tourism Tools within destinations and enable tourism managers to make SMART decisions when implementing technology into their touristic resources. Furthermore, it has been intended to lead to the creation of a conceptual framework that will be designed to visualize the deep and complex concepts raised. The following now seeks to ascertain the fulfilment of that goal and the research question put forward at the beginning of this thesis.

6.1.1. Main Research question and sub-category questions:

How can destinations make the link between SMART Tourism Tools and Touristic resources in order for tourism managers to make SMART strategic decisions?

The above main research question will be concluded on in the final section of this chapter once the following sub-category questions have been resolved:

SMART concept

The origins of the SMART concept

Initially starting with the idea that technology can improve and deal with global issues, SMART Planet was down-sized to exist on a smaller experimental scale as SMART Cities. Since then SMARTness has evolved into a new way of thinking where technology alone can no longer resolve problems faced by large cultivations of people. In this, the information collected by technological systems can be used in order to make the right and SMART decisions. The SMART concept is necessary for destinations to create and enhance cities, not just for tourists but also for its residents. Better decisions lead to competitive destinations, the management of systems and the preservation of resources.

Infrastructure requirements for SMART Tourism Tools to function

Indirectly, the development of SMART Cities facilitates seamless access to value-added services for tourists of a city, like access to real-time information on public transportation. Systems initially were not set up for tourism consumption. However, in short SMART Tourism Tools take advantage of:

- Technology embedded environments (IoT, Sensors, etc...),
- Responsive processes at micro and macro levels (Intelligent services),
- End-user devices (i.e. smartphones, etc...) and
- Engaged stakeholders that use the actively use platforms to offer services (information, etc...).

SMART Tourism is reliant on four core areas: *information and communication technologies: IoT, mobile communication, cloud computing, and artificial intelligent technology*, which all pre-exist in SMART cities. These technologies connect the physical, information, social, and commercial infrastructure of tourism, and supply SMART Tourism value to multiple stakeholders of a destination.

SMART Tourism destination

Defining a SMART tourism destination

In short, any destination can become a SMART tourism destination by consisting of and involving the concepts of Soft and Hard SMARTness. As uncovered during primary research, the following definitions were also supported by the literature reviewed within.

- Soft SMARTness: **collaboration, innovation, leadership** (human capital)
- Hard SMARTness: **Technology and infrastructure** (Heart of SMARTness)

The concept of Soft and Hard SMARTness means that destinations cannot simply embed technology into their environment and automatically believe it is SMART, therefore, the Soft aspects refer to the human capital and the SMART decisions that can be made based on the information gained through technical systems.

The principles of *SMART Tourism Destination* is to enhance the tourist travel experience, provide more intelligent platform to gather and distribute information within destinations, facilitate efficient allocation of tourism resources and to integrate tourism suppliers at both micro and macro level aiming to ensure that benefits from the sector are well distributed to local society. This can be done through providing consumer valued services, which can be in the form of SMART services or *SMART Tourism Tools*.

The *SMART Tourism Destinations* seeks to enhance tourism experience which can maximise destination competitiveness, and thus, increase consumer satisfaction whilst applying sustainable techniques.

Profile of known users of these SMART tools

Generation Y: NET Generation were identified as the most travel tech savvy users. Furthermore, the following characteristics were recognised to be relevant to the SMART Tourism Tool user:

- Well-connected and well-informed,
- Active critics and buzz marketers,
- Demand highly personalised service,
- Engaged both socially and technologically,
- Dynamically discuss through social media,
- Co-create experience,
- Contribute to content,
- Utilise end-user devices in multiple touch-points.

In terms of the future, as urbanised environments become even more ubiquitous and well connected through IoT, vast amounts of data will become increasingly more available and there is a clear demand for this information need while on-site already, SMART Tourism Tools act as an enabler to access resources. Highlighting the strong need for destinations to incorporate new technologies and provide the services reflecting demand not just for Gen-Y but the generations that are late adapters.

SMART Tourism Tools

Defining SMART Tourism Tools

Findings from secondary and primary research aided in the formulation of the following SMART Tourism Tool definition (pg. 63). The statement reflects the multiple aspects involved and shows the complex nature that it is. In addition to highlighting its physical attributes, benefits for the tourist and destination are outlined clearly.

“Smart Tourism Tools are a combination of **mobile hardware, software** and **networks** that enable an **interactivity** between **tourists, stakeholders** and **physical objects**. This **communication** allows tourists access to **personalized services** providing in some cases **real-time information**. The **tracking** and **collection of Data** via these systems enables stakeholders to **manage** destinations **effectively** and **efficiently** when making decisions”.

The selected SMART Tourism Tools defined

This study focused on three specific SMART Tourism tools, these are: Mobile Applications, Augmented Reality & Near Field Communication. Based on the research, the following definitions have been formulated to represent their overall context.

Applications:

“An Application is a Small piece of software that enables a specific goal to be achieved through the exchange of information”.

Augmented Reality:

“Augmented Reality is an overlay of information on top of the surrounding real-world environment to provide additional data on a current position. A device with a digital screen is required in order to superimpose this artificial layer of information, such as a smartphone or lens system (i.e. Google Glass)”.

Near Field Communication:

“NFC is short range wireless radio communication protocol that can function between a tag/chip that transmits data stored on it to an electrical device that read/receive the data. Further, NFC can be used to communicate between different devices without the need for configuration, for example, between two different smartphones/tablets pressed very closely together to send very small amounts of data like a picture or share information like contact details without the need for authorization/passwords”.

Positioning SMART Tourism tools within the touristic resources of a destination

The Conceptual Framework presented in this thesis demonstrates the interrelated complexity of the subject. The framework brings together 3 different technologies and also brings forth the many different aspects involved in their functionality when applied to a touristic resource. Clearly, this framework requires further research, however, it provides the initial foundations through defining the SMART Tourism Tool concept and integrates the 6 A's of a tourism destination (Attractions, Accessibility, Amenities, Available Packages, Activities and Ancillary Services). It is argued that the simple positioning of the “6 A” symbols can enlighten the reader in regards to the positioning of SMART Tourism Tools within a touristic city.

SMART Tourism tool functionality and benefits

Due to the high complexity, the technical functionality of these tools cannot be briefly detailed, although, they have been clearly described within. However, the above definitions on the SMART Tourism Tools APPS, AR and NFC visibly demonstrates the overall function each tool has.

In terms of benefits, SMART Tourism Tools were found to have a variety of rewards for both destination and tourist.

For destinations:

- Economic rewards: through investments in new innovations, promotion and the saving of unnecessary costs through utilising real-time data and understanding the city needs better.
- Successful implementation of *SMART Tourism* has the potential attract Foreign Direct Investment. These investments can to last a long time because getting the correct infrastructure in place will shape a destination for the next decades and thus ensuring its sustainability
- Meet the demands of evolving markets and provide layers of new digital content, thus, extending the life of tired attractions.
- Big Data: gain the competitive edge by allocating optimal resources which may lead to sustainable tourism development. Tracking mass tourism and dealing with it informatively.
- Differentiation is key: offering digital services beyond the tangible and intangible attributes of a destination, such as scenery, attractions, heritage and local people to compete with similar destination with same assets.
- Forming digital communication channels to ensure that the “Silent Traveller” remains reachable during their on-site phase.
- Increase distribution channels for tourism providers.
- Cultural Heritage: preserve, re-build, entertain and re-live old time through Augmented Reality. Providing additional value in digital and educational ways.
- Improve city services, transportation, etc...
- Promotion of brand via inspiring tourists to share content on stakeholder platforms and SMART Tourism Tools.

For tourists:

- *SMART Tourism Tools* offer convenience of user-friendly interfaces, up-to-date information and affordability.
- Technology embedded within a destination’s environment can enrich tourist experiences and thus enhance destinations competitiveness
- Reduced expenses: ability to access offline digital information via SMART Tourism Tools. Further, ability to connect with destination free Wi-Fi services.
- Extension of services and re-vitalisation of tired attractions through providing new digital content on-site. Simply, extra layers of value.
- Constant availability and access to relevant information. Thus, greater decision-support and mobility leading to enhancement of experience at the destination.
- Inspiring on-site time through the provision entertainment and informed location based services. For example, the “Exploration” in Augmented Reality displays the immediate visible surroundings and overlaid information on new content.

- Translation services: APPs/AR/NFC
- Navigation: To find locations but also to find new and unexplored POI's.
- Paperless travel.

SMART Tourism tool alignment with the touristic resources of a city

It has been decided that no one SMART Tourism Tool aligns with one specific touristic resource. Therefore, this is why the framework incorporates the Touristic City concept (Red line) to reflect the Historical, Cultural, Night-life and shopping aspects of a touristic city. Furthermore, the framework demonstrates the ability of the Tools diversity by being able to move from one resource to another seamlessly and yet be still highly effective in its duty.

Situations most suitable for SMART Tourism Tools

Firstly, to make clear, SMART Tourism Tools are very diverse and thus stating at this point is a challenge without further research. Although attempts have been made in the following:

The themes outlined in the discussion; *Seamless Connectivity, Sharing Economy, Financial, Visual Content, Language, Privacy and Wearables*, strongly represent case scenarios to when possible suitable situations of SMART Tourism Tool use.

Moreover, the conceptual framework has tried to visualise situational use with the inclusion of the 6 A's of a tourism destination. Symbol represent the different aspects of a destination resources and aligns them with potential SMART Tourism Tools.

Lastly, the benefits listed above also provide insight into suitable situations that SMART Tourism Tools could be used for.

However, it must be noted that one area that SMART Tourism Tools transpired often was within Cultural Heritage and therefore, tourism managers should strongly consider this resource as a big potential for SMART Tourism Tools.

The most appropriate SMART Tourism Tools to implement into a SMART tourism destination

This has been a difficult question to answer in this thesis because technology is changing so rapidly that perhaps a future focus of research should be on, for example, "What tools can be implemented to enhance the tourist experience?" Therefore, focusing on the tourist and not the destination could create a better understanding of the needs of users, thus meeting those needs on a longer term is more achievable to the development of new tools.

As every destination can vary dependant on its touristic resources, tourism managers should consider the themes outlined in this thesis (*Seamless Connectivity, Sharing Economy, Financial, Visual Content, Language, Privacy and Wearables*). Due to the complex nature of the subject it is difficult to give a single round answer to what is the most appropriate to implement into a destination. However, the conceptual

framework presented in this document is the first step to appreciating the opportunities available with the implementation of SMART Tourism Tools for destinations.

In addition, it can be concluded that this research did not fully meet its goals but has laid down the first building blocks for future research and explore the complex concepts further.

6.1.2. Answering the Main Research Question

How can destinations make the link between SMART Tourism Tools and Touristic resources in order for managers to make SMART strategic decisions?

Based on the previous parts of this chapter, this thesis has answered the fundamental proportions of this question. However, due to the vast subject and rapid developments of technology, it will always be a challenge to fully fulfil its desire. Although, the information contained here has attempted a detailed venture into a previously little discussed subject, with the exceptions being the few leading researchers in tourism and technology who are still in the early stages of doing so. Therefore, it can be stated that SMART Tourism Tools is in its infancy and the work here lays way for future research where inevitably the demand for this knowledge will thrive in the industry.

In reference to the research goal that, it can be defended that deeper knowledge and know-how has been presented for tourism managers to make a move towards SMART decisions when considering the implementation of SMART Tourism Tools into destinations. Moreover, as sought, a conceptual framework is now available based on this research that visualises the complex subject. Even though, this framework needs additional research, it is clear that its potential is supported.

In conclusion, it can be verified that there is a link between SMART Tourism Tools and Touristic resources of a destination. The increasing demand for these services is already strong and is only yet to increase further by tourists. Additionally, the rewards that these services can provide destinations is also positive and therefore tourism managers should be looking beyond the contents of this thesis to practically implement technologies within their own destination in the near future.

6.2. Recommendations

This thesis has outlined several themes on SMART Tourism Tools but in effect has also highlighted areas within technology in tourism on the whole. In a modern age, these themes are highly crucial for consideration by destinations when making decision to implement SMART innovations. Tourism mangers and researchers should strongly consider these themes in relation to SMART Tourism Tools: Seamless Connectivity, Sharing Economy, Financial, Visual Content, Language, Privacy and Wearables. In doing so, they can allow for the opportunity to make SMART strategic decisions.

The following pages (68/69) are supported by the findings gained in literature and the semi-structured interviews.

6.2.1. Recommendations for tourism managers

This section is intended for tourism managers seeking to gain insights on considerations and on moving forward with technology within their destination.

- Do not presume by having Hard SMARTness, technology embedded environments, that instantly a destination becomes SMART. Instead, consider the importance of Soft SMARTness where “Collaboration, Innovation and Leadership” are crucial to ensuring SMART strategic decisions can be made.
- Invest in systems that have the ability to collect BIG Data, i.e. SMART Tourism Tools and infrastructure. In doing so, informed SMART decisions can be made and further, efficient improvements of services can be conducted. Understanding what is happening within a destination can help deal with issues, such as, mass tourism and sustainability of resources.
- Co-Create: technologies can lead to better communication between many stakeholders, tourism managers and businesses allowing destinations to interact with not just tourists but also residents which enables all persons to be a part of the products. Thus, leading to enhanced experiences.
- Do not force technologies onto tourist: technologies should be seamless where interaction with SMART Tourism Tools is not complicated. Moreover, the tourist should have the freedom to choose whether to use new technologies but also informed of the benefits if they do so. In this, offering extra value in digital services.
- Enhance Tourism Experience: focusing on the benefits for the tourists can lead to being a desirable destination. In doing so, it will lead to becoming a competitive destination globally and thus benefit itself in financial ROI. Intangible rewards for tourists can lead to tangible rewards for destinations.
- 3rd party platforms: creating SMART Tourism Tools independently can be costly, slow, complex and difficult to maintain. Therefore, it is recommended to utilise 3rd party specialists in technology who can use your content to create something new and exciting for tourists. A destination should understand the needs of its tourists and manage the direction of SMART Tourism Tools whilst allowing technology experts create and maintain the complex issues involved. However, destinations should remain in control and not do something just because somewhere else does it successfully already. Moreover, international platforms like Facebook and booking.com should be utilised with the destinations own content and thus not go into competition to create their own social and booking platforms for a destination when these platforms are already strong brands.
- Cultural Heritage: SMART Tourism Tools enable storytelling and inspirational experiences. Furthermore, this digital education can re-vitalise tired attractions.
- Wearables: recognise growing trends in wearable technology and how this could be utilised into the tourism experience. APPLE Inc. is driving the way for convenient moneyless payment systems, it is arguable that this will transpire into admittance for attractions one day.
- Privacy: ensure users that data is secure thus improving the acceptance of such technologies by persons.
- On/offline service: provide free Wi-Fi within infrastructure and/or SMART Tourism Tools that can be used offline in order to save on roaming fees. Tourists appreciate the convenience of these services and thus enhance their time on location. In return, destinations are able to track their visitors and gain new understandings of what is occurring at the destination.

The following is now intended for future researchers seeking to extend the work within this thesis.

6.2.2. Recommendations for future research

- Conceptual Framework: clearly stated the framework set out within is only the first steps to completion. It is therefore advised that a new perspective maybe required to re-enforce the validity of its intended goal. Due to the vast complexity of the subject, further tools may be needed to be researched and the links strengthened with the touristic resources that can be formed.
- Narrowing research was advised by interviewees. In this, areas to also consider is the acceptance of such SMART tourism Tools by tourists. This is an area that can aid the successful implementation of such services through understanding the tourists needs better.
- Rapid developments of technology: be aware that technology is so rapidly changing that not every SMART Tourism Tools can be constantly documented. Therefore, some of the broader concepts undertaken within have allowed to cover a wider spectrum of concepts. Unfortunately, at times, specifying multiple specific tools can be time-consuming. It can be advised that by focusing a future thesis on just one of the SMART Tourism Tools mentioned within can also produce exciting results.
- Contact the Bournemouth University Tourism Lab for support and directional approaches to technology and tourism. These PHD researchers are extremely open to discussing and sharing their relevant research within this subject.

7. Limitations

It must be stated, for the purpose of advising future researchers, the SMART Tourism Tool concept is very broad. Therefore, to narrow the research would be advisable to concentrate on one tool and research how these tools could specifically enhance tourist experience. Additionally, another angle to research would be the acceptance of these new technologies by tourists.

It is now realised that a vast amount of the content contained within this thesis has been difficult to compile. However, due to lack of previous research on the matter, it is also justified that so much extensive detail has been given. Furthermore, due to limited provision of future orientated courses on tourism innovation at the NHTV University, it has been necessary to conduct additional self-learning to reach the intended goal.

In recommendation to focus further research, it is advised to contact PHD researchers of the Bournemouth University, England (details in Appendix). From the experience of the writer, these persons have in-depth experience of current and future tourism technology trends, thus can aid new researchers to pinpoint future questions to be asked efficiently.

Finally, technology is so rapidly changing that most research is difficult to keep up with. Therefore, by researching the tourist needs and understanding why tourists use such tools can also lead to helping destinations to implementing new innovations in their destinations.

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Appendices

Appendix 1

Application Examples in Use:

Location specific APPs

Airport

Airports in the USA are now offering APPs that can reduce waiting times in queues to enter the country. These digital passport APPs replace the traditional paper declaration forms and enables visitors to submit their passport/customs information via their smartphone. The “Mobile Passport” app is free to download and is fully authorized by US Customs and Border Protection.

It works by allowing the tourist to submit APP information along with personal profile data to US Customs. After authorities review the submitted data, Customs send a digital secure bar-coded receipt back to the app. The tourist can then proceed through the arrivals area to the Mobile Passport Control, then placing the digital bar-coded receipt from the smartphone screen onto a barcode scanner. A customs person will then check the passport. (McCormack, 2015). Furthermore, the APP can be used in conjunction with NFC technology (to be discussed shortly).

This technology used on this level demonstrates the potential to be used in other instances. In this, conferences, attractions, events and transportation could easily utilise this type of software allow admittance to venues. The need for printed tickets/forms can be replaced by digital wallets securely locked on personal devices. Tourists travelling abroad can easily carry all required documentation on their smartphones never fearing to have forgotten a printed version. *These examples will later be referred to again in the NFC context.*

Airlines

KLM’s ‘Like the Crew’ APP allowed passengers to rate flight experience on a 5-point scale. It was designed with the in-flight passenger in mind. Further, Virgin in Australia, Lufthansa and Japanese Peach Airlines are introducing APPs that allow their passengers to access and control the entertainment system in-flight simply via personal mobile devices. (McKelvie, 2014).

Hotels

A way that hotels and a few tourism companies are assisting customers is by using technology to engage with guests from the booking and after their departure stages through social media and email. Live chats with “e-advisors” are another way that travel stakeholders, hotels and airlines engage with customers. (McKelvie, 2014). However, more recently the application market has seen entrance of the E-hotels / SMART hotels. These new concepts are giving mobiles users more power with every swipe. An example of this is the “HUB”.

The HUB hotel in Covent Garden, London UK, is at the forefront of the SMART hoteling. From the booking process, to check-in, to room access, to room-service and physical control over the room environment/experience (TV, temperature, lighting, etc.) is controlled via the downloadable HUB APP. (Premier Inn, 2014). In addition, the APP also provides basic AR to point out nearby POI. This new concept recently opened has shown much success already and proves the potential to exist in reality is possible. This SMART Tourism Tool truly places full control into the tourist's hands, although the reduced physical contact with hotel staff could be also seen as a negative by certain tech-phobia visitors.

Further Tourism APP Examples

[Malaga tourist guide / audio app](#)

As previously discussed earlier, the Malaga application is a native based audio guide. This means users are able to visit POI around the city and be guided in a language of choice. Being native, user are not incurred with roaming charges.

Information is offered on more than 95 interest points to which 84 of them are enhanced with audio. Additionally, photos, information on opening times, phone and web pages are included on each POI. "The City of Málaga puts all the tourist information on Málaga in the palm of your hand with these applications" (Ayuntamiento de Malaga, 2015). With an additional inbuilt map it much easier to find monuments and GPS location services are also available but requires internet connection. Although, with the vast amount of resources pre-installed on the device, any minimal downloading massively reduces roaming changes if needed. City Council are very keen to help tourists discover the birthplace of Picasso and soon city free Wi-Fi will be introduced.

[Museum APPs](#)

Museums are an ideal location for the involvement of technology. Applications enable the past to be enhanced and offer a new form of entertainment within fixed structures. Sensors can be easily installed connected to nearby servers enabling the tourist to gain information to their smartphone via free Wi-Fi/Bluetooth.

Kuflik et al.'s (2014) trialed a research mobile APP guide using on-site location aware software at the Hecht museum, Haifa. It involved proximity detection between the APP and fixed beacons placed in points of interest (POI) around the museum. The visitor carrying their own smartphone is free to walk around in the museum whilst being tracked. The pre-installed APP contained all information required about the museum.

Once a visitor is detected at a POI, the nearby beacon reports this to the server. The system then presents the user with a selection of objects close by to the APP. The user then can select a specific object which would then offer a list of relevant questions. Once the visitor selects a question, a short video is played, providing a multimedia answer.

Moreover, when the visitor first arrives at the museum, they are able to follow a personalised tour/route. This system guides the visitor through the museum using GPS navigation (location based software). The visitor is then able to view a museum floor map and request directions to POI's as when needed. The software was also possible to apply to group visitors. In this case, small groups that had split up could see where their group members are situated on the museum map. Further, virtual messages could be sent to other group members. A highly useful SMART Tourism Tool for individuals and groups touring cultural attractions.

The research concluded that "the use of a mobile guide significantly changed the way visitors behave in the museum" (Lanir et al. 2013a, as cited in Kuflik et al., 2014, p.21). These changes included: an increased time spent in the museum by visitors and an increased attention to exhibits themselves was found. However, the electronic museum guide was also found to detach visitors from their group. (Kuflik et al., 2014). This Museum tourist guide clearly highlights the potential for adding an extra layer of value to the tourism museum visit. Further, through extending the services offered within cultural sites they are able to stay complete and in-line with consumer desires to interact digitally.

[Seoul City, Korea: Tourism APP](#)

Seoul is one of the world's most connected cities (Jordan, 2011), it is a great example of an innovative destination.

In addition to the Seoul Convention Bureau website and VisitSeoul.net where tourists can find useful information and interactive maps, visitors can hire special smartphones installed with i-Tour-Seoul upon arrival. This APP is based on the Seoul Tourism Organization's official website and a downloadable version is also available on personal devices, however, tourists will be charged with roaming costs. The APP comes in several languages and consists of an electronic travel guide on the city to a real-time information service. Hence, the rented smartphone is highly cost effective.

Furthermore, by using the smartphone's GPS, tourists are able to constantly be updated on nearby POI, accommodation, dining, weather, exchange rates. Moreover, users can also point their camera at the surrounding area to access the "iTourSeoul's Augmented Reality". This quickly provides details by overlaying icons/info similar to Google Street. Explanations of precisely what is being looked at will appear, for example, whether it be a Starbucks or UNESCO World Heritage Site like Changdeokgung Palace. More will be discussed on this later.

SMART bus stops in the city offer route normal paper information combined with Quick Response (QR) codes which can be scanned by the smartphone and then provide real-time transport information in the language of the user's choice. (Jordan, 2011).

Conference APPs

The emergence of Conference specific APPs have provided to perfect platform for business travellers to stay up to date with proceedings. Destinations such as Barcelona have implemented the “Smart City Expo World Congress” which offer services/features, including:

- Information on the activity programme,
- Speakers, including detailed information.
- Sharing contact info during the event.
- Exhibitors info.
- Schedule, location and layout of the event.
- Following twitter hashtags.
- Adding favourite speakers, sessions and exhibitors.

In addition to Conference specific APPs, applications like “YAPP” designed for groups and non-specific events, is making it easier for any type of multiple persons to communicate. This APP offers features like:

- Invitation – allowing only selected participants.
- Schedule – real-time info.
- Polls – Vote and see the results real time.
- People – bios on people, sponsors, and key contacts
- News Feed – Connect with others and receive breaking news via push notifications
- Photo sharing – Take and share photos.
- Video - Playback video.
- Offline browsing – Important content without internet.

YAPP was recently used at the NHTV conference for “Cities in Transition”. It demonstrated convenience and the ability to question key speakers in real-time. Further, important information was quickly and easily re-laid. Conference APPs display great means of reducing waste whilst staying completely interactive with participants over very short periods of time.

Appendix 2

Augmented Reality Examples in Use

AR APPs in services

GraffitiGeo

GraffitiGeo is a AR **restaurant recommendations** APP. Users point their phone towards a restaurant and immediately see the reviews for that establishment (Chillión, 2014)

Yelp: AR browser

Yelp is probably one of the most successful AR browser's (Todorov, 2013, p. 4). An AR browser is well suited for the needs of tourism because it enriches the real-world with interactive information that allows visitors to identify unfamiliar locations/POI whilst learning more about their surroundings. This APP in specific offers mapping for global destinations and is not aligned to anyone destination. It therefore is important for stakeholders of a destination to maintain content to improve their own marketing opportunities.

Madrid Subway: Augmented transportation

Madrid **Subway** is a good example of destinations providing an AR system as a tool to guide tourists through unfamiliar environments. Originally, **navigation** and way-finding was one of the first assignments of AR. AR in this context has the "potential to reduce the mental effort required for both pedestrian and auto navigation" (Todorov, 2013, p. 9). The APP is designed to show virtual paths and directional arrows to guide users indoor and outdoor. Furthermore, it can be used offline and thus highlighting once again the benefits to tourists roaming. Another example of this type of APP is the "Nearest Tube" in London, which displays the appropriate route to gain access to underground stations from the user's current location. This incorporates the mobile GPS to always ensure the user knows exactly where they are.

Google Translation: Augmented reality translation

In addition to providing information and directions, **Translation** tools in unfamiliar environments can also significantly influence the tourist enjoyment of a holiday. Foreign language signs and instructions can be very confusing, therefore, APPs like the "Google Translate" can read foreign languages and augments the translation to the smartphone. Further, this tool can be applied almost anything with writing, even menus and timetables for example (Todorov, 2013, p. 10). Fortunately, this APP can even download all needed language to the phone and thus no need for Wi-Fi.

Augmented Reality Case Study

The Dublin AR project

The **Dublin AR Project** was based on a partnership between Manchester Metropolitan University (MMU), Dublin Institute of Technology (DIT) and the Dublin City Council. The project's goal was to support Dublin's brand identity to development its 'innovative city' position in Europe. Han et al. (2013) researchers from

MMU set out to develop a mobile AR APP for the tourism industry in Dublin. In trials it was applied in different touristic parts of the city. The application provided “a platform to superimpose tourism relevant information, reconstruct and revive stories of the past, assisting the tourist in creating an emotional experience of the intangible product” (Han et al., 2013, p. 512).

Dublin’s aim was, and still is, to be the first European city to implement an AR infrastructure. This would be for the purpose of benefitting tourists, citizens and any stakeholders that could advance the city development. Furthermore, Dublin desires to be a ‘test-bed of innovation’ for new ideas and help its promotion of the destination (Han et al., 2013, p. 512). The Project trialed a test AR APP and conducted interviews of tourist’s to understand their perceptions/experience of the APP. The following brings forth the early findings of Han et al.’s research on the Dublin AR project.

[The Dublin AR Project findings](#)

Han et al. (2013, p. 513) found that AR has big potential for the tourism industry. In this, they found that a tourist with “little or no knowledge of the environment” with a location-based device (Smartphone with GPS) can access information in the immediate surroundings. This therefore offers great benefit this industry through connecting with the tourist/user. Furthermore, the application of their AR APP on devices has “the potential to create the next generation of computerized tourist guide” for tourists in general who are interested in their nearby environment.

On the technical side, the researchers also concluded that in addition to locating the user, the AR APP should also provide background information and deeper depth of the area that might be of interest. Thereby, though providing continuously updated and modified information it would improve efficiency and functionality of the APP. Thus, it was sort to offer “mobile utility”, meaning up to date transport time and locations through the AR screen. Moreover, the AR APP should be able to guide tourists to certain location via navigation and provide location-based information on the area. This could be selected at will by the onscreen clickable options.

Han et al. (2013, p. 513) state that “the tourism industry requires constant investment into new technologies, preferably for mobile use, in order to continue attracting visitors” and therefore, highlighting the need for destinations to be constantly innovative. These new technologies offer these opportunities to do so. Luckily, for destination stakeholders the majority of smartphones now provide GPS-map inbuilt systems which can pinpoint tourist’s exact location. Thus, the tourist already possess the tool, it is simply a matter of the destination to provide the connection/service to communicate with its visitors. In this, an AR APP (Han et al., 2013).

Appendix 3

NFC Case Studies:

Airports: Check-in & advertising

Fast Airport Check-In

Air transportation information technology provider “SITA” recently demonstrated how integrating NFC technology in mobile devices can move travellers through the airport more smoothly. Consumer trials showed positive results that NFC can actually be used to improve airport efficiency. The principle is that a boarding pass information can be stored on a smartphone, meaning that users are able to **check-in, open doors, and/or get access to lounges** by simply scanning their phone over a reader rather than using traditional papers means. Further, it does not require an APP like QR codes. This is because data is written directly handset NFC chip.

As SITA is part of the aviation industry, it is believed that there is a likely chance that this will eventually be deployed at the most airports the company manages. Chillión (2014) states that according to developers, “a passenger using an NFC-enabled device can be processed faster than any of the current boarding processes available today”.

Immigration forms

The previous example showed how airlines could potential allow smartphones for check-in. However, the following is currently being used in the USA by **Customs** to deal with immigration queues at **passport control**.

The “Mobile Passport app” (*as detailed in the previous APP chapter*) allows travelers submit their passport and declarations information using their smartphone instead of filling out paper forms. Once installed on an NFC device, travelers are able to create a personal profile with their passport details. Further, once landed, users are able to submit their completed customs declaration forms over the APP and join the dedicated lane for Mobile Passport users and thus speedy their exit of the airport. Currently the APP is only in operation at Miami Airport and for US nationals. Though shows great potential for the travel and tourism industry (McCormack, 2015).

The previous two examples Cleary show a massive potential for tourism attractions to incorporate ticket admissions, either via dedicated APPs or the NFC technology in Smartphones.

SMART Poster Technology-Enhanced Airport Experience: Australian Airports NFC Service

Sydney, Melbourne and Brisbane **airports** in Australia provide an example in which tourists can interact with “Google Play” store content by scanning NFC tag’s on advertising panels.

Smartphone users can also choose to download selected books, movies, music, magazines or apps directly to their phone using the free airport Wi-Fi service. “This campaign is a real example of how the traditional billboard and technology can work together to create a deeper connection between a brand and an

individual [...] It also demonstrates how well online and digital billboards work together, and how smartphones can drive deeper forms of engagement and enable consumers to connect and enhance their experience on-the-move online” (Neuhofer & Buhalis, 2013, p. 4).

Smart maps

Similar to the earlier concept of Smart posters, “Smart Maps” are however portable. Just like traditional maps from the tourist office, Smart Maps are embedded with NFC tags to a regular paper map. These are designed to “enhance the perceived value with an innovative idea, simply by adding the NFC feature to the core of the product” (Ronay & Egger, 2014, p. 2).

The small “Midas” NFC tags (measuring 12 x 19mm and a memory of 168bytes) are stuck to the back of the map. The tags are placed under key attractions, when scanned, a link will be opened on the internet to more information on the POI. Due to the small NFC tag size, they instantly show a positive aspect over QR (quick response) codes which dominate the space on printed paper. In the sense of a map, obscuring the most relevant and needed information.

Ronay & Egger (2014, p. 2) concluded in their trial that “the Smart Map is a good example of an innovative idea, connecting ubiquitous ICT and tourism”. Even though only trialled, the Smart Map shows much potential for **tourism offices** and offer tourist digitally enhanced experiences.

Clarion Hotel, Stockholm

The first hotel to use NFC technology as a room key was the Clarion **Hotel** in Stockholm. The trial lasted 8 months in 2010 and 30 frequent guests were chosen to be participants, each given an NFC-device. After booking a hotel room, a confirmation was sent to the device (smartphone). Before arrival the guest was reminded via an APP on the device to check-in electronically, then an access code and room number would be downloaded to the device. Therefore, checking-in at reception was not applicable to them. With the use of this designated app, they were automatically enabled to gain access to the room with the digital key code transferred from the NFC device to the door lock (Clampet, 2015).

On departure, check-out was conducted by waving the smartphone close to the RFID tags located at exits or by the APP on the smartphone. Thus, providing multiple options and convenience. Once checked-out the room key deactivated and access lost to the room. This ensured maintain confidence and security in the system. Trials proved that security had also improved and where necessary lost/stolen devices could easily be blocked remotely to deny illegal entry to rooms.

The trial further provided ample feedback of the experiment from visitor and staff. Participants stated that the advantage was the time saved in the check-in and check-out process. Moreover, guests also saw potential in the system to pay for food, drinks and other services by their smartphone in the future. In addition, it was also noted that guests thought that maps and information about local attractions/service and transport could be beneficial in the APP. The final advantage was stated that this new NFC system

easily works with existing RFID locks and thus implementing a new digital room key system could use the current hotel hardware. (Pesonen & Horster, 2012, p. 14)

[The City of Nice](#)

France has been conducting several trials of NFC for consumer use. One example is in the City of Nice, 2010. The introduction of the NFC concept ran under the name of “Cityzi” rather than NFC as it was believed to be more user friendly (Pesonen & Horster, 2012, p. 15). Huge co-operates were established between the Association Française pour le Sans Contact Mobile (AFSCM), four major mobile operators, two banks and the operator of public transportation. To ensure the success of the program, the mobile companies put 4000 NFC enabled phones on sale at a time when little was known by the consumer of NFC tech.

The project’s aim was to enable all users (visitors/residents) of the **public transport** system to pay for travel on NFC smartphone. In addition, to be able to use smart posters to access tourist information and get up to date schedules on **buses and trains**. Even earning loyalty points in some stores was made also possible (Balaban, 2010 as cited in Pesonen & Horster, 2012).

To help users, a website was created to explain the options offered by Cityzi. In this, the website lists four major options: Payment, Transport, Information and Loyalty Points (Ronay & Egger, 2013a, p. 568).

The French government is keen to expand NFC projects and offered investments for cities who wanted to implement NFC into their own infrastructure. Of 42 cities that applied for funding, only 9 were awarded the money in 2011. Therefore, NFC services are expected to be introduced in some key French cities in the near future. One known city is Strasbourg who implemented the same system as Nice successfully. However, additional NFC parking meters have been implemented into Strasbourg **car parks** (Pesonen & Horster, 2012, p. 15)

[Mobile APP EpicMix at the Vail ski resorts](#)

Designed for Vail **ski resorts**, “EpicMix” is an APP for Smartphones launched in late 2010, Colorado. It’s slogan “Capture. Connect. Share” offered ability to track “physical accomplishments” and share them with personal social networks. In the five resorts of Vail, all **ski lifts** (89 of them) have been equipped with RFID scanners.

“The RFID lift ticket stores ski passes and location-based data. When passing by an RFID detector, the location of the person is transferred to the application. As there is a very well developed Wi-Fi connection in the Vail resorts, it is possible to find friends and family members on the mountain in real-time as well as to connect, share and message them via the application or another social network. In order to encourage users, they can earn virtual ski pins based on their vertical feet accomplishments. Trail conditions, weather and traffic are also displayed” (Pesonen & Horster, 2012, p. 15).

Due to the check-in process is automated, the user does not have to manually activate the service. Thus the user is free to enjoy their selves whilst recording their ski achievements. Later, the user is able to view

skiing routes of their visit as the location-based data is tracked automatically to the APP. Moreover, Social updates can also be pushed automatically to Facebook and twitter. This enables users to keep in touch with friends near and away. Especially, convenient to re-join friends lost friends on the mountain side.

Security and Privacy is deemed to be low as the user is able to turn of tracking and limit the number of persons viewing achievements.

Recent changes planned extended RFID scanners beyond ski lift entrances to also cover different areas and enable precise tacking. Especially handy for safety and social purposes while conducting extreme remote sports. Furthermore, tracking could also lead to rewards based how much persons had skied over a period of time (Pesonen & Horster, 2012).

[The Museum of London](#)

In addition to the previously stated example of augmented reality, the **Museum** of London and London Docklands launched an NFC trial of the two museums focusing on the history of London late 2011. It was in cooperation with Nokia. Visitors, even to this day, are now able access information at about 90+ RFID tags around the two Museums. This smart museum concept is designed to enhance on-site access to digital cultural heritage (Ruotsalo et al., 2013).

On top of the normal information points below artefacts, tickets for exhibitions can be purchased via the NFC links and further visitors can “like,” “follow” or “check-in” on Facebook, Twitter and Foursquare automatically. An additional APP can further be downloaded to work in tandem with the NFC tags. The “Sound Track to London” APP allows visitors to hear sounds of old days in London's history (Pesonen & Horster, 2012, p. 15).

The NFC trial focuses on social elements between users and the **Museum** beyond the usual friend networks. This is known as the “Friends Scheme of the museum”. Thus, At the entrance of the museums, visitors can join the scheme (by swiping NFC enabled device) and gain “access to special events, free entry to special exhibits, a museum magazine and 20% discount on goods at the gift shop”, these vouchers can then be downloaded within the museum at appropriate NFC tags. The information points (NFC tags on artefacts) give visitors additional digital information, photos and videos. The results of the trial have proven to be popular and effective (Swedberg, 2011, as cited in Pesonen & Horster, 2012, p. 15).

The system created by Nokia enables businesses to host campaigns and track the use of every tag so that the data can be measured. Obviously, highly beneficial acquiring big data for analysis. In addition, Nokia supports business by setting up tags and smart posters. Therefore, providing the expertise to make these changes available to other businesses (Pesonen & Horster, 2012, p. 15).

Google field trials

Google has launched NFC trials in three cities in the USA (Portland: Oregon, Austin: Texas and Las Vegas: Nevada) from 2010 to 2011. It was NFC-based marketing system designed for visitors to be a “the ultimate tourist pocket guide.”

The Google trial gave **stores/restaurants** NFC enabled window decals (stickers) saying “Recommended on Google.” These embedded NFC tags once scanned by a user would aim to make recommendations on the Google Places APP easily/conveniently accessible. Visitors are then able to find/write recommendations by “simply waving their phone over the sticker” (Brown, 2011c as cited in, Pesonen & Horster, 2012, p. 16). Furthermore, all useful information such as opening hours, sales, contact information and relevant data was instantly available to the customer, reducing the effort to search manually for the desired restaurant or store. Additionally, the Google Places APP could be combined with the Google services like the Google Maps APP and provide visitors with alternates, reviews and navigation.

Most notable of the Google NFC trials is the company’s NFC payment service “Google Wallet” launched in 2011. Trials were conducted in retail stores in New York for contactless purchases and on the New Jersey **transit system** to purchase travel tickets. The trials of Google Wallet has seen little adaption by consumers in the recent years (Pesonen & Horster, 2012, p. 16). However, due to Apple’s successful attempt at “Apple Pay”, consumers are now more open to the benefits and security of the system. It is evident that payments made by NFC smartphones will grow in further strength in the coming years. Benyó, Vilmos, Kovacs, and Kutor’s (2007, as cited in Pesonen & Horster, 2012) research on NFC payment solutions for retail stores concluded that with NFC eliminates the need to stand in line in order to pay. Thus, beneficial for tourists also attending attractions, using transport and paying for services/products.

Appendix 4

Interview Questions and Summary of answers

Interview 1 Summary



Name: Jim Hendriks

Current Profession: 2nd Year Game developer student, NHTV Breda.

Date of interview: 1st April 2015

Background:

- Development of mobile applications (NFC, AR). Personal experience of BETA trials of AR.
- 10 years of games code writing and development
- Internship in creating applications for tracking health/diets. Social sharing information to motivate healthy eating and gamification.
- Games designer and production : management
- 3rd yr. IGAD student
- Aspires to be Game developer/producer manager.

SUMMARY:

1. **Are you familiar or could possibly guess what *SMART Tourism Tools* are /might be? WORD ASSOCIATION**
 - Smart tourism tools: smartphones, ability to interact with city and gain information
 - SMARTPHONES
 - For tourists to take pictures.
 - “Tourists walking around a city and gain information”
2. **Could you suggest technological innovations that could aid tourists at a destination?**
 - Suggestions on technological innovations at a destination: Augmented Reality at Dublin Guinness brewery. No APP required, free Wi-Fi provided at the attraction. No roaming charges, Web based APP.
 - Dublin Guinness brewery. AR shows the process of the beer being made.
 - The process became see through. No app required. Internet provided free for the attraction to enable the AR to function without personal financial cost.
3. **What is an APPLICATION?**
 - “a way of accessing more detailed information or something very specific with a specific goal in Mind”
 - Apps provide ways of completing specific goals. I.e. google maps: to find your way. Facebook app: to socialize with friends.
4. **APPS: What types of Applications for tourism are relevant?**
 - Apps that can be relevant to the city you are in and see a lot of information about the highlights and select local bars/restaurants
 - Information APPs providing preferences
5. **What is NFC?**
 - “NFC is the next step from Bluetooth”
 - “Just a way to communicate information wireless by just holding it near to something. Connector/receiver and share information”
6. **Where / what do you think tourists could potentially do with NFC in a destination?**
 - Tourist location: NFC connector could offer info so that there is no need to carry a guide book all the time.
 - Tourism Route through city: shows info about what you are seeing and where to go next.
 - NFC connectors: dotted around the city at tourist locations. Offering information at what they are looking at; history, facts, links to apps showing the next route/NFC location of interest.
 - No mobile internet: preloaded app with all the information previously downloaded.
 - With internet: connect to a website.
7. **What is Augmented Reality?**
 - “When you add something to the reality”

- Add something virtual to something you see and not replace.
- Example: Roman theatre: point phone at arena and see a gladiator fight. See old time. Rebuild something destroyed.

8. Are you familiar with SMART Cities? Example?

- Dublin
- Positive experience of AR in the city

9. Any thoughts on the questions I have asked? Or anything you feel I should know on the subjects mentioned?

- Gamification: NFC routes could offer points. Scavenger race: explore the city in a new and exciting way. Done with friends competing.

Interview 2 Summary



Name: Katerina Volchek

Current Profession: PHD Researcher Bournemouth University LAB / Tourism & Marketing MSc student at School of Tourism at Bournemouth University

Date of interview: 3rd April 2015

Background:

- For more than 6 years Katerina has worked at Solemare, one of Belarusian Tour Operators in the sphere of outbound tourism, dealing with Product Management, Online Marketing and Sales.
- interests in Online Technologies
- Currently doing Master Programme in Tourism Management and Marketing. She is particularly interested in eTourism, Online Marketing and ICT in tourism.
- 2014 member of Bournemouth University eTourism Lab and is going to conduct a research in the sphere of marketing attribution for tourism.

SUMMARY:

1. Could you suggest some technological innovations that could be used by tourists at a destination?

- Track information / exchange information between tourist and destination
- Multiple devices
- Access social profiles
- Improve services: “identify a tourist from an social and economic group you can offer exact services they are looking at”

2. How would you define an APP?

- A Program that can help a client to communicate with someone: a DMO, a business that provides products or services. A way of exchanging information

3. How do you think tourists could use an APP in the on-site phase? More than just bookings

- Getting information about a destination
- Making a reservation in real time
- Check in services via mobile
- Real time communication between hoteliers and customers on social media
- Korea: hotels give smartphones during period of staying, providing free internet, calls. Extra value and analysis behavior

4. Can you define NFC in a tourism context?

- Technologies that allow “People to exchange information on a lot of distance”
- Referral to colleague “Kim Boes” who specializes on the subject NFC.

5. Can you define Augmented Reality? EXAMPLES WITHIN A DESTINATION?

- Heritage
- Glasses,
- Marriot user: inspire customers to visit
- Exciting topic:
- “Provides people with great experiences”: makes life more easier/convenient
- Tourists want:
- “Unique experience is how companies compete now”

- Business can use ICTs: Creating something unique for clients: showing clients what that can receive once onsite
- 6. HOW do you think AR / NFC / APPS could be used by destination for tourists to use while in the on-site phase? (How do you think a tourist can utilize AR?). USE BY ATTRACTIONS? HOW?**
 - Personalized service unique: facebook recognition. Businesses know your face and details.
 - Difficult for big business to gain ROI on AR implementation
 - It's about smaller companies utilizing other APPs : google maps, TripAdvisor, etc. small companies who cannot create something themselves can use those services to benefit their own company
 - Negative: if AR is too good then people could skip the trip
 - NEG future: " great future and offer unique value" it enable co-creation: tourists want to participate in the creation of experiences, AR enable this
 - 7. Are you familiar with SMART Cities? Example destination?**
 - They can be used to deal with traffic jams
 - Gathering data
 - 8. Do have any word associations with the term: SMART TOURSIM TOOLS**
 - "be on time- information – exchange – In order to improve services"
 - 9. Any thoughts on the questions I have asked? Or anything you feel I should know on the subjects mentioned?**
 - Narrow subject, topic is really huge.
 - Focus on a destination, business or application. To evaluate the information.

Interview 3 Summary



Name: Rachel van der Meer

Current Profession: 4th Year IGAD student. On Placement Philips

Date of interview: 6th April 2015

Background:

- 4th year IGAD. ARTs program. Specialisation in home environment at Philips.
- Internship: AUGMENTED reality specialist
- Current research projects:
 - Internship: Philips. Google engine in virtual reality.
 - Simulation dynamic lighting effects

SUMMARY:

- 1. Could you suggest some technological innovations that could be used by tourists at a destination?**
 - AR: "overlays on mobiles phone to point them to tourist attractions"
 - "depending on the locations of where these tourists attractions are they might have to be preloaded because they are in an area without proper internet connection you can only work with what you have on the phone directly" thus practical
- 2. Can you define Augmented Reality? In own words**
 - "AR is overlay onto the real world via your smartphone or wearables"
 - "Without cameras it's just overlay that use the information of the surrounding environment to provide additional data onto your position"
 - "for example: with google glass or the new HOLO lens by Microsoft"
- 3. EXAMPLES WITHIN A DESTINATION? How could it be used by tourists?**
 - Android app: location based services
 - Google maps
- 4. How would you define an APP?**
 - "a small program that can provide small services or can give you entertainment, in addition, a small piece of software that can standalone or work as part of a network"
- 5. How do you think tourists could use an APP in the on-site phase?**
 - Apps can: provide info, translations, emergency services
 - "mainly to provide information at a destination"
- 6. Familiar with: Can you define NFC in a tourism context?**

- “NFC is small/short range communication protocol that can either work between a tag which is like a dumb chip that just sends out the data it has on it or it can be used to communicate between different devices like for instance between different smartphones/tablets. It can be used to let devices know where they are, share information through these NFC tags”
7. **What potential does NFC hold for destinations? Does it have a place in your business research?**
 - NFC Car tags: on in the car triggers the changes on smartphone device for appropriate settings like diverting calls and activating satnav.
 - Re-installing android devices quickly without hassle.
 - NFC tourism: “at tourist places like museums where tourists can scan information points at paintings/sculptures/historical artefact and then their phone allows it to provide voice communication , for example translation in their native language in instance”
 8. **HOW do you think AR / NFC / APPS could be used by destination for tourists to use while in the on-site phase? (How do you think a tourist can utilize AR?). USE BY ATTRACTIONS? HOW?**
 - No Answer.
 9. **Are you familiar with SMART Cities? Example destination?**
 - “Not really”
 10. **What potential is there for SMART cities and tourism in the future?**
 - “Eindhoven is a smart city with dynamic lighting but I know little about this”.
 11. **Do have any word associations with the term: SMART TOURSIM TOOLS**
 - “mobile devices, smartphones, wearables”
 - **“Toolbox”**: the smartphone holding many different APPS. “One piece of hardware can run many different applications that fulfil many different roles, like a tourist information, medical tools, etc.”
 - **“the tool”** would be the individual app
 12. **Any thoughts on the questions I have asked? Or anything you feel I should know on the subjects mentioned?**
 - Wearables: smartwatches, trends from last year. New devices are rapidly increasing and innovation is getting better and better. However, converting consumers will be difficult due the cost and trend of analogue watches
 - VR: in a destination could help with homesickness, offering visuals into new destinations, when flying on a plane and see outside.
 - **Smartphone is a “Toolbox”**
 - **The different software’s would be the “Tools”**

Interview 4 Summary



Name: Kim Boes

Current Profession: PhD Researcher at the eTourism Lab at Bournemouth University, UK.

Date of interview: 9th April 2015

Background:

- Specialist in Smart Tourism Destinations.
- Bachelor and Master’s degree in Innovation and Management in Tourism of the University of Applied Sciences Salzburg, Austria.
- Research assistant in Austria
- Adventure tourism background
- Interest in technology and social media
- Masters in NFC Smart Posters
- Future profession: Consultancy. Holistic and seeing opportunities in business

Kim’s thoughts on SMART concepts:

- “How should Tourism destination should imply smartness” and what this will bring them, and how to increase their competitive advantage
- Conclusions: define smartness:

- Smartness is more than technology
- How smartness functions in smart cities
- Smart concepts: “collaboration, innovation, leadership.... Very important to be able to become a Smart tourism destination”
- Technology can be perceived as the heart of smartness: infrastructure
- ... from this, better develop innovations , easier to work together, “all called soft smartness”
- Smart cities: a layer of soft smartness and hard smartness

SUMMARY:

1. Could you suggest some technological innovations that could be used by tourists at a destination?

- “Technology moves fast and we have developments all the time”
- New specific technologies aren’t important, it’s the acceptance of them
- “what is out there must be easy”
- “a tourist doesn’t want something that is very difficult to use”
- “they don’t want new things all the time”
- Technologies should be seamless. They are not seen. People don’t want to feel like they are being looked on /spied on all the time
- Information, touch screens: Implemented within the environment
- “tourists shouldn’t be pushed to use a certain technology”
- “Technologies are changing all the time”

2. Familiar with: Can you define NFC in a tourism context?

- Smart posters / tag
- Centre: bus stops, menus, maps,
- NFC: “basically use it anywhere”

3. What potential does NFC hold for destinations? Does it have a place in your business research?

- NFC: “Not being appreciated enough”
- Because: “NFC is and was , is that APPLE was not using it”
- APPLE PAY: doesn’t let users use NFC in a normal way. APPLE: “has being stopping the breakthrough of this technology”
- However “it is getting better now and we hope in the future they will just go and accept it” NFC users.
- Most consumers just don’t know what NFC is. 2-3 years previously at conferences, people are surprised by NFC. Really surprised people haven’t heard of NFC. NFC is extremely cheap, safer and cannot be manipulated. More attractive than QR codes.
- “It is a shame that NFC isn’t used more.”
- NFC Future: consumer acceptance: people need to be educated more on NFC to improve the acceptance and its use in daily life should be increased where it becomes normal.
- “The industry needs to explain it more to the consumer” this will improve consumer acceptance.
- NFC is enabler: the consumer needs to do nothing apart from hover their phone over a tag. The user doesn’t need an APP for it to work.
- “NFC can offer anything” picture, link to website, telephone number, anything on there!
- Smartphones and tags “NFC links to two information sites, so it’s only an enabler” you don’t need any kind of APP for it.
- Train station example: at the station there was a poster, if the user hovered their phone over the station name, the user would be linked to the train website with the current station already loaded. Then the user would only have to add final destination to gain information on the route they intended to travel on.
- Maps in Salzburg: scan an NFC poster, information on the background attraction would be displayed to the person on their device.
- NFC works also offline: companies can use it for timesheets. It can also link with other forms of telecommunication. However, most people use it in conjunction with the internet.

4. Can you define Augmented Reality? In own words

- “when you use your phone to look through your phone and you see the normal/physical environment extra information added on top”

5. EXAMPLES WITHIN A DESTINATION? How could it be used by tourists?

- AR: “It can be used with anything, in tourism it is very nice to have”

- **Issues** with having to hold the phone all the time in the hand. Therefore, wearables would be more convenient in the future.

6. Are you familiar with SMART Cities? Example destination?

- “the problem is We don’t have any smart tourism destinations, we have smart cities at the moment”
- Barcelona and Amsterdam are good examples. Basically what they are doing is not focusing on tourism. They have many ways of monitoring and being more sustainable. They are definitely not using it on tourism.
- Spain: Spanish Telecommunications Company is pushing to have their first smart tourism destination by summer 2015. Making usage of Wi-Fi and that it is available everywhere.
- “To be able to be a smart tourism destination, you have to be a smart place, you have to be a smart city, because its more than only tourism”
- SMART is just a BUZZ word at the moment, to be a smart tourism destination, you need to fill in many layers and not just be focused on technology.
- Smart thinking is crucial

7. What potential is there for SMART cities and tourism in the future?

- SMARTNESS: “the world population is growing and with that we put more pressure on our environment, and with technologies we can better see what is going on and better make better solutions for problems that we have.
- Smartness can resolve Mass tourism. Smartness can control this and see what’s going on and make better decisions.
- Co-creation: it’s important that tourists are part of their product. Better communication, not just between the stakeholders and the tourists but between the tourists and the residents. Smart cities can help people to work together through better communication and understanding, thus improve the lives of those who live at the destination. INCREASE THE TOURIST EXPERIENCE.

8. Do have any word associations with the term: SMART TOURSIM TOOLS

- Sensors, M to M, NFC, mobile phones
- AR, NFC, APPS.... **Actually information tools**. They do more things than just within the smart environment, they are within STT’s but only a small part of it.
- Smart bigger perspective (systems) “technology = Hardware, software, networks”
- Advancements in telecommunications – faster
- Hardware now smaller
- DATA: NFC gives us data. Systems and **sensors** are giving us the **BIG** data.
- **NFC, AR, are only giving us a small part of that data**

9. Any thoughts on the questions I have asked? Or anything you feel I should know on the subjects mentioned?

- Advice:
 - The rapid changes are so fast.
 - Short term concepts
 - Need to see an overview: why people use this?
 - **Provide us with information in easier ways**
 - My thesis idea is very difficult because it is so broad
- NFC, AR, APPS are so fast and it’s very difficult to keep up with it.
- “Everything is pushed towards us, one day the environment will talk to us”

Interview 5 Summary



Name: Oliver Davies

Current Profession:

Date of interview: 8th April 2015

Background:

- Video game designer and producer
- Now lecturer at NHTV and head of master innovation coordinator
- Application, AR developer

- **Current research projects:**
 - Virtually to promote destinations. Offer experience of real location
 - Current AR projects that cannot be spoken about due to privacy.
 - Previous KLM APP: in process of launch.

SUMMARY:

- 1. Could you suggest some technological innovations that could be used by tourists at a destination?**
 - Whole range of things: “we’ve seen already a number of industries are being disrupted by technology”
 - Taxis’: Output disrupted by UBER
 - Hotels: disrupted by AIRBNB
 - “There’s a huge range of tourist specific industry which can be disrupted by applications”
 - The tourism industry is happy about the tourist being connected, information can be compared instantly by the tourist.
 - Limitations: Roaming.
 - Intermediaries: Suggestions on places to go and things to do
- 2. Can you define Augmented Reality? In own words**
 - Mixed reality
 - AR: “artificial reality layered over the real world”
 - On Smartphone screen
 - Lens system: wearables
 - “superimposed over the real world”
- 3. EXAMPLES WITHIN A DESTINATION? How could it be used by tourists?**
 - “LAYAR” : early software
 - Berlin wall: superimposed and see how the city was
 - AR: see changes
 - Guide us
 - Offer POI
- 4. How would you define an APP?**
 - “A piece of software. Designed to perform specific function or range of functions”
- 5. How do you think tourists could use an APP in the on-site phase? More than just bookings**
 - Mapping: directional
 - Tourist advisory: Informational
- 6. Familiar with: Can you define NFC in a tourism context?**
 - “a form of radio communication between devices over short ranges”
 - 8-15cm in size
- 7. What potential does NFC hold for destinations? *Does it have a place in your business research?***
 - Not all phones are capable of NFC
 - Tourism example of NFC: “bring a phone close to a menu outside of a restaurant and brings you instantly a version which is your own language”: reads the language of the phone and then changes (translation)
 - Instances to receive useful pieces of information
- 8. Are you familiar with SMART Cities? Example destination?**
 - New York: recently being talked about
 - Stockholm:
 - Major areas generally leading the way
- 9. What potential is there for SMART cities and tourism in the future?**
 - Smart cities are a trend: “move towards cities that are increasingly managed and based upon digital technology”
 - “Large urban cultivations” that’s where the improvements and efficiencies are needed.
 - “Eventually everywhere will be SMART”
 - LONG TERM: Tourist destinations outside of the cities will allow these types of technologies and solutions
- 10. Do have any word associations with the term: SMART TOURSIM TOOLS**

- Applications like LAYAR: can be modified in a way that can suit any case
- “Personalized applications which respond to our specific needs”

Interview 6 Summary



Name: Marc Thalen

Current Profession: IGAD STUDENT NHTV: Specialisation in NFC

Date of interview: 9th April 2015

Background:

- Game designer
- Specialisation in NFC in APPS
- Gamification of playing cards with NFC tags
- 3rd year IGAD
- **Current research projects**
 - 4 player card game

SUMMARY:

1. Could you suggest some technological innovations that could be used by tourists at a destination?

- NFC: really short communication
- Bluetooth technology 20 meters
- Wi-Fi transmitter 200m of Wi-Fi
- QR codes

2. Familiar with: Can you define NFC in a tourism context?

- “Transmitting really small amounts of data between the chip –transmitter and the receiver”
- So for really small amounts (data)

3. What potential does NFC hold for destinations?

- NFC / Bluetooth: can be used independently
- Example: “if you visit a specific spot, you can put a Bluetooth dongle in there. You can give like people let’s say more information about that area. In shopping you can give a discount when in the store”
- NFC example: “more useful in museums, if there is a work, you can tap your phone on it and you can get information”
- Can be use offline: NFC chips: user has an APP and the” NFC triggers something in the phone and therefore NFC is reliant on DATA”
- Example: NFC, Hotel entrance and security doors
- Further: a dedicated APP could be offer by hoteliers. Once the customer is on-site, Local information could be offered on trips and offers current available.

4. Can you define Augmented Reality? In own words

- AR: “Scanning a sticker, the sticker has data loaded into an application, the application transfers it into a 3D model. the 3D model posted into an Augmented sticker and looks like it is the real environment”

5. EXAMPLES WITHIN A DESTINATION? How could it be used by tourists?

- No answer

6. Are you familiar with SMART Cities? Example destination?

- No answer

7. What potential is there for SMART cities and tourism in the future?

- Not asked

8. Do have any word associations with the term: SMART TOURSIM TOOLS

- “Bluetooth dongles: you get more information via your smartphone”

9. Any thoughts on the questions I have asked? Or anything you feel I should know on the subjects mentioned?

- NFC: “already starting to become out of date” “chips need to be constantly updated with new data to stay relevant”

- Consumer acceptance of technology: “it’s positive however, consumers still have security issues when paying for services”
- Digital Pickpocketing: Can be prevented with security software’s and through being aware of physical contacts. Luckily the NFC is reliant on close contacts. Therefore, NFC must be physically actioned by the user to work. Smartphones can’t be digital pickpocketed. Payments must be manually authorized and therefore, personal details cannot be easily intercepted unless the user allows data to be copied.
- Hotel doors: hotels can be easily transform into NFC Smartphone key accepters as the current Hotel doors will already accept the new technology. Thus reducing the financial burdens of updating hotel services.

.....

- **Marc demonstrates his current project. Pictures below**
- **TAG Writer: Assigning NFC tags with information and to his smartphone**

Interview 7 Summary



Name: Marjolein Visser

Current Profession:

Date of interview: 13th April 2015

Background:

- Marketing consultant in the services industry (tourism/healthcare/finance/etc.)
- Specialist in ONLINE marketing / content
- Tourism: was a tourism guide and teaches tourism Students
- Lecturer at the NHTV part-time
- Author of MARKETING/business books

- **Marjolein introduction thoughts:**

- Pushing ICT “the tourism business in general, the people involved have to be forced into the new world”, difficult to bring new ideas to businesses and they are slow to react. Only when they see it happening they act too late.

SUMMARY:

1. **Could you suggest some technological innovations that could be used by tourists at a destination?**
Digital Trends
 - DIY holidays
 - Smartphone providing constant reminders and direction. Everything will inform u through your device.
2. **How would you define an APP?**
 - “A tiny/little piece of software that functions on its own within a wearable” designed just to do one specific thing.
 - “Data is important not the APP” the app is just a platform to offers the ability to provide information.
3. **How do you think tourists could use an APP in the on-site phase?**
 - Location of REPS: tourist in
 - Services will guide tourists through the whole holiday, “as long as they say yes” to accepting the control.
 - APPS: can make the decisions for your day. Taking in to account issues ahead, for example, the weather is bad so the smartphone will make alternative/relevant plans for that day.
4. **APPs: What type of Applications for tourism are relevant?**
 - Beacons at destinations that offer information/short stories/ AR with info
 - Or free tablets at the destination
5. **Where do think these APPs fit into an area / destination / products / infrastructure? (Specific uses/area/resources of a city)?**
 - APP museum: walk around with wearables and provide audio information on nearby attractions. Like stories.

6. **Can you define Augmented Reality? In own words**
 - “AR is digital support for what you really see”
 - It’s about holograms, 3D projections
7. **EXAMPLES WITHIN A DESTINATION? How could it be used by tourists? Organizational benefits**
 - Historical sites: ROME, coliseum and see how things used to be
 - Benefits to destination: offer points of information in a new way that gives a uniqueness of the destination. “A more complete experience” showing tourists a story.
 - Creating an attractive city with new ICTS
 - ICTs shouldn’t be forced on tourists and should be seamless/invisible for tourists to use and prevent for example, a “Disney ROME experience”
8. **Familiar with: Can you define NFC in a tourism context? How could a company implement**
 - NFC “if you have something wearable and if you are very close to things, you can make contact and exchange data”
9. **What potential does NFC hold for destinations?**
 - Potential: exchange information with a museum when you visit
 - Not practical: NFC is reliant on being close and you only want just one person to receive data. But for payments is perfect
10. **HOW do you think AR / NFC / APPS could be used by destination for tourists to use while in the on-site phase? (How do you think a tourist can utilize AR?). USE BY ATTRACTIONS? HOW?**
 - Intelligent services: proving automatic preferences
 - Negative side effects: tourists loose the exploration and become reliant on services being presented without researching for selves.
11. **What do destinations have to consider when implementing tourism ICTS?**
 - DATA: “if you promise people to do something, then you have to so it”
 - Data should be up to date and given in “Real-time”
 - “It’s about real-time all the time!”
 - Destinations need to be able to deal with Big DATA. Keep safe, and store the right stuff. These are big challenges.
12. **Are you familiar with SMART Cities? Example destination?**
 - SMART companies make smart cities based on many different ideas to form a community of smartness. Helping cities to make good/right choices.
13. **What potential is there for SMART cities and tourism in the future?**
 - Benefits: Making better decisions to control flows
 - deal with issues of tourism
 - Attract tourists
 - Predict hotel bookings
 - SMART cars: self-driving cars. The need for UBER will be gone.
14. **Do have any word associations with the term: SMART TOURSIM TOOLS**
 - “wearables, NAVI, digital guides, Robots, data (tourist numbers), payments
 - SMART Tourism tools for: the city, the tourists , transport
15. **Any thoughts on the questions I have asked? Or anything you feel I should know on the subjects mentioned?**
 - The problem: the tools are so fast changing, that it’s hard to keep up with technology. Therefore, investments are huge and making the right choices is crucial to stay up to date.
 - The ICT developments are rapidly changing
 - History of the internet: 2000 saw a massive demand for the internet and built in strength rapidly. Previously, it was presumed to be a hype.
 - Potential contact: IBM specialist. Will email for me for potential email.
 - Future: robots that guide tourists within facilities (closed environments). For example, airports robots guiding lost tourists to departure gates when late.

Interview 8 Summary



Name: Tomas van der Plaetse

Current Profession: IT Tourism Consultant

Date of interview: 27th April 2015

Background:

- Working for tourism Flanders for 10 years
- Online marketer
- Currently: Consultant in web analytics, tourism focused
- Global traveller

Current projects

- Denmark tourism branding

SUMMARY:

1. Could you suggest some technological innovations that **could** be used by tourists at a destination? **Digital Trends**
 - Digital tourists: “using their phones for everything you can imagine”
 - “Booking and finding information in the destination itself”, “closer to the actual travel so mobile become more and more important” which means “sites like TripAdvisor and yelp are very relevant and used”
 - “For digital tourist these tools are a no brainer”
 - More experience content: (spotted by locals) information on POI’s, opportunities to enhance experience. Story telling in an interesting way, digital guides. Video blogging. “Richer content” through technology, **encourages people to share it.**
2. How would you define an APP?
 - “you can apply it to something on your phone”
 - “Native apps allow you to do things offline”
 - “Web apps linked to online”
 - “Adds value to what they want to achieve at the moment” from tourism view “ to find something or to make your experience better”
3. APPs: What type of Applications for tourism are relevant?
 - OJOO: (Gamify your world) create own content and story of travels. City guides created on 3rd party software. Not just the normal attractions (example, street art locations)
 - Belgium: Map of Brussels – Treasure hunting content
 - KRUMB app (location-based app): publisher of content, hide content (simple version of geo Caching). Gamification: hiding treasure around the city and **increase customer experience.** Participants go around the city looking for “Breadcrumbs” of interesting content.
4. Where do think these APPs fit into an area / destination / products / infrastructure? (Specific uses/area/resources of a city)?
 - “Niche marketing approach”
 - Implementation of apps: Better to use 3rd party apps. “The apps are already out there”. Booking.com does it better.
 - Flanders promotional app: Beer app (niche marketing) Niche apps, focuses on the subject and provides the best information for that subject.
 - Promoting on 3rd party apps. Better to use own data to entice others parties to use it.
 - Building own app is too time consuming “building, maintaining, slow, complex, costly”
 - “Destinations should work on their strategic partnerships with companies” to build niche apps. Entice them to create good content. I.e. beer app: work with the breweries.
 - **“it’s better to think niche niches than to say we have all this data we should just dump it in a mobile app because that’s not going to work”**
5. Can you define Augmented Reality? In own words
 - “A situation where users can virtually enter into in different ways to a digital world where they can more around by using different functionalities on their smartphone”

6. EXAMPLES WITHIN A DESTINATION? **How could it be used by tourists?** Organizational benefits
 - In tourism: “look through their phone and see different things on the landscape”
 - Negative: expensive technology and overhyped. ALWAYS having to hold the smartphone.
 - LAYAR: Dutch app. Created app for Flanders tourism board. Sent their data to LAYAR. Left them to use the data.
 - **Promotion is important to get the APPS to be successful**
 - **LAPIFICATION: experience the northern lights anywhere in the world. Massive PR for the brand Lapland.**
 - **Visit Norway: Oslo: northern lights. When to see where and when. Better customer experience. Promotion of strengths and brand.**
7. Familiar with: Can you define NFC in a tourism context? How could a company implement
 - “Better than QR codes”
 - “shouldn’t be pushy onto the user than it’s a good thing”
 - For destinations: Option to follow. Data base content
 - **NFC “Can improve experience by providing the right information at that spot”**
 - Easier to implement now than ever before
8. What potential does NFC hold for destinations?
 - Ghent: museums
 - **NFC ideal for now and in the future as more people become more confident in using it**
9. **What do destinations have to consider when implementing tourism ICTS?**
 - Remember why you are building something.
 - **Goal should be “How to get the visitor while at the destination and how you can use them to improve experience by offering the right tools at the right time. Some destinations forget this.”**
 - Not only focus on the inspirational phase of travel but also remember the actual travel phase to connect with the visitor.
 - Customer visitor cycle: Residents are important for sharing their own experience to encourage visitor from outside to visit that area. Facebook and Instagram experiences are good for destinations to tap into. Rather than promotional platforms but rather using user generated content to promote a destination.
 - Strategic thinking: analysis what people are using online and then employ specific persons to manage these environments/contents (person to specifically work on TripAdvisor improving their destination). Rather than creating a new app and employing a lot of IT, developers and promotional costs, utilize strong established platforms.
 - **“These are difficult decisions for destinations to take: there are not many destinations that actively work on TripAdvisor; for example, take advantage of the TripAdvisor experts promoting their destination. Big issue is lack of strategic. Lack of thinking why they actually need an app”**
10. Are you familiar with **SMART Cities**? **Example** destination?
 - “Broader than tourism alone”
11. What potential is there for SMART cities and tourism in the future?
 - Vancouver: V-POLE: pole in the middle of the city. Free Wi-Fi. Download apps. Offered a lot of value and brings people together. Offered functionality.
 - “Cities clearly understand that should provide Wi-Fi everywhere because if you have it people will be sharing your destination, it’s the wisest thing to do first”
12. **Do have any word associations with the term: SMART TOURSIM TOOLS**
 - **“Improve customer experience onsite – that would be smart”**
 - **“Inspiring” and “Fun”**
 - **“Another level of experience”**
 - From the view of the destination and marketing

Appendix 5

Word Association coding exercise

During the interview, a key term was introduced to the interviewees. The thesis theme of “SMART Tourism Tools” was presented to the participants who were asked to give their initial thoughts/word association to the term. The below table outlines the responses of each interviewee:

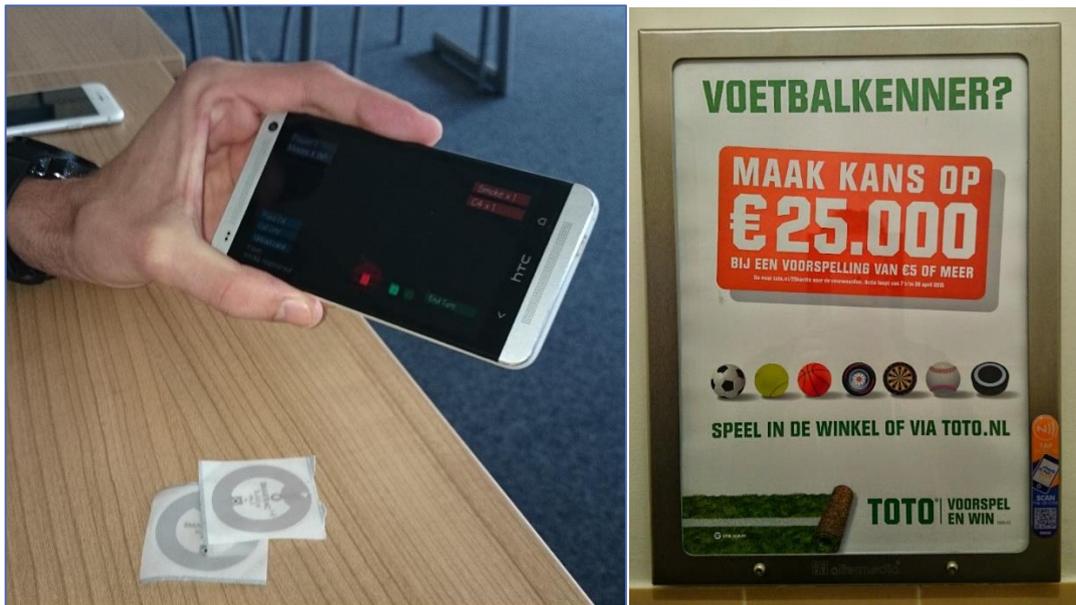
Interviewee	Code level 1	Theme
Jim Hendriks	<ul style="list-style-type: none"> ability to interact with city and gain information SMARTPHONES For tourists to take pictures. “Tourists walking around a city and gain information” 	<ul style="list-style-type: none"> Interactivity (between people, the city and physical objects) Informational Hardware Touristic use/Services
Katerina Volchek	<ul style="list-style-type: none"> “be on time- information – exchange – In order to improve services” 	<ul style="list-style-type: none"> Real-time Informational Data collection Management efficiency
Rachel Meer	<ul style="list-style-type: none"> “mobile devices, smartphones, wearables” “Toolbox”: the smartphone holding many different APPs. “One piece of hardware can run many different applications that fulfil many different roles, like a tourist information, medical tools, etc.” “the tool” would be the individual app 	<ul style="list-style-type: none"> Hardware
Kim Boes	<ul style="list-style-type: none"> “Sensors, Mobile to Mobile, NFC, mobile phones” AR, NFC, APPS.... Actually information tools. They do more things than just within the smart environment, they are within STT’s but only a small part of it. Smart bigger perspective (systems) “technology = Hardware, software, networks” Advancements in telecommunications – faster Hardware now smaller DATA: NFC gives us data. Systems and sensors are giving us the BIG data. NFC, AR, are only giving us a small part of that data 	<ul style="list-style-type: none"> Tracking Communication Data Collection (Big Data) Information services Portable
Oliver Davies	<ul style="list-style-type: none"> Applications like LAYAR: can be modified in a way that can suit any case “Personalized applications which respond to our specific needs” 	<ul style="list-style-type: none"> Software Personalized services
Marc Thalen	<ul style="list-style-type: none"> “Bluetooth dongles: you get more information via your smartphone” 	<ul style="list-style-type: none"> Hardware
Marjolein Visser	<ul style="list-style-type: none"> “wearables, NAVI, digital guides, Robots, data (tourist numbers), payments SMART Tourism tools for: the city, the tourists, transport 	<ul style="list-style-type: none"> Hardware
T. Plaetse	<ul style="list-style-type: none"> “Improve customer experience onsite – that would be smart” “Inspiring” and “Fun” “Another level of experience” From the view of the destination and marketing 	<ul style="list-style-type: none">

Appendix 6

NFC picture examples



Above Left & Right: NFC tags.



Above Left: NFC tags scanned by Smartphone.

Above Right: SMART poster example.