From Sagas to Spreadsheets

Navigating Iceland's voyage into Smart Tourism

By

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This thesis is submitted for the degree of Msc in Data Analytics

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Abstract

From Saga to Spreadsheet

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This thesis explores the implementation of smart tourism initiatives in Iceland, a unique context characterized by various challenges and opportunities. Through a qualitative approach involving in-depth interviews with key stakeholders in the Icelandic tourism industry, the research identifies a complex ecosystem marked by fragmentation. A grounded theory approach has been used to analyse the data resulting in the identification of six key themes.

Findings reveal gaps between theoretical frameworks and practical realities in Iceland. Identified challenges include an immature data infrastructure, resource constraints, a lack of data literacy, and difficulties in collaboration and data sharing. This study contributes to the theoretical understanding of smart tourism by extending frameworks to account for the specific needs of small markets.

Based on these findings, this thesis proposes several actionable strategies for overcoming the identified obstacles. The research highlights the potential for Iceland to become a leader in smart tourism implementation and in data analysis for destination management.

This study tries to fill a gap in the literature regarding the implementation of smart tourism in smaller market, it offers valuable insights for policymakers, industry stakeholders and researchers in the field of tourism management and data analytics.

Keywords: Smart tourism, Iceland, Data analytics, Tourism industry, Implementation challenges, Grounded theory, Big data analytics, Data ecosystem, Digital transformation, Stakeholder collaboration

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AUTHOR'S DECLARATION PAGE

I declare that this thesis is my own work and has not been submitted in substantially the same form for the award of a higher degree elsewhere.

No sections of this thesis have been published or submitted for a higher degree elsewhere.

This research was conducted independently, and I confirm that I am the sole author of this thesis. The nature and scope of any assistance received during the research and preparation of the thesis have been acknowledged within the text.

Samuel Kohler

CHAPTER 1 INTRODUCTION

The concept of smart tourism emerged as a game changer in the travel industry and academia by reshaping how destinations handle and enhance visitor experiences. This evolution is primarily tied to the rise of digital technologies which transformed the tourism sector. The past decade has witnessed a surge of technological progress and tourism expansion, laying the foundation for the development of smart tourist initiatives.

This convergence is quite visible in Iceland. From 2010 to 2023 Iceland saw a boom in its tourism sector where the number of yearly visitors surged from under 500k to close to 2 million (Statistics Iceland, 2023). This increase in tourism aligns, with the growing trend of travellers staying connected globally and the widespread adoption of technologies and smart city projects (Gretzel, Sigala, *et al.*, 2015). Iceland's special status as a tourist destination with its own unique geographical and economic characteristics makes it a perfect example, for studying how smart tourism ideas are put into practice.

Smart tourism represents a convergence of information, communication technologies and tourism and transforms data into onsite experiences and business value propositions (Del Vecchio *et al.*, 2018; Gretzel, Ham and Koo, 2018). This transformation requires efforts and initiatives at the destinations, to collect and aggregate data from various sources, and utilising advanced technologies with a focus on efficiency, sustainability, and experience enrichment (Gretzel, 2017).

The concept of smart tourism is based in the broader concept of smart cities, which emerged as a response to urbanisation challenges through the application of information and communication technologies (ICT). As cities started using technology to improve resource management and quality of life for residents, the potential for similar applications in tourism became evident. Smart tourism builds on this concept, by focusing on improving the visitor experience while simultaneously addressing the unique challenges faced by tourist destinations. In this context, smart tourism represents a holistic approach to destination management, by integrating data from diverse sources to create more efficient, sustainable, and personalised tourist

experiences. It encompasses a wide range of technologies and practices, including the Internet of Things (IoT), artificial intelligence, big data analytics, and mobile technologies, all aimed at creating a more connected and responsive tourism ecosystem.

However, the implementation of smart tourism initiatives, particularly in rapidly growing markets like Iceland, generate both opportunities and challenges. There is a necessity to define the practical implications of smart tourism (Shafiee *et al.*, 2022). This study seeks to explore these challenges and opportunities specific to the Icelandic context, contributing to the growing body of research on smart tourism implementation. By examining the unique elements influencing the growth of smart tourism development in Iceland, this research aims to bridge the gap between theoretical concepts and practical implications to offer valuable perspective for policymakers, industry stakeholders, and researchers alike.

1.1 SIGNIFICANCE OF THE STUDY

This study on the implementation of smart tourism initiatives in Iceland is significant on multiple levels. Firstly, it has the potential to offer substantial economic benefits for the country. By optimising resource allocation, enhancing visitors experience and improving destination management by the effective use of data analytics, the industry at large and the authorities could potentially increase its revenue and competitivity in the global market. Secondly, the study addresses important implications, which are particularly relevant given Iceland's strong focus on sustainable tourism (Althingi, 2024). Smart tourism technologies play a role in overseeing and managing the environmental footprint of tourism, safegarding the unique landscapes of this country and preserving it for future generations while still allowing for economic growth. Lastly, this study contributes to the research domain by contributing to the field of the smart tourism studies. By focusing on Iceland's unique position as a small island nation with a rapidly evolving tourism industry, this study brings new perspectives into the existing body of knowledge of smart tourism initiatives.

1.2 PROBLEM STATEMENT

The adoption of smart tourism in Iceland faces notable hurdles due to a underdeveloped theoretical and practical framework. The integration of data analytics for value creation in the tourism sector faces hinderances such as data privacy, difficulties in data and resistance to change. There exists a disparity between the ambitious goals of smart tourism and its actual application at an organisation level. This gap extends to the tourist experience, where the potential benefits of smart tourism have not yet fully realised in Iceland.

This issue is worsened by the lack of research on smart tourism in markets like Iceland. While numerous studies have focused their aim in major cities, there is a lack of research addressing the unique challenges and opportunities presented by small markets like Iceland. This knowledge gap hinders policymakers and tourism stakeholders in making well-informed and data-driven decisions regarding investments and strategies. Such research is crucial to ensure Iceland can fully leverage the benefits of these technologies while addressing its specific challenges.

1.3 RESEARCH AIM

This study aims to bridge the gap between theoretical frameworks of smart tourism and the practical application in the Icelandic context. By using a grounded theory approach, the study aims to identify key barriers that hinder the practical implementation of smart tourism and offer actionable advices and strategies for overcoming these challenges. The study will explore the limitations faced by stakeholders in accessing and utilising data. Ultimately, the research seeks to contribute to the advancement of smart tourism practices, by providing a roadmap for the Icelandic industry to fully embrace the potential of smart .

This research is significant as it fills a void in existing literature concerning the execution of smart tourism initiatives. With a focus, on Iceland this research aims to offer valuable perspectives that could benefit other destination encountering comparable hurdles.

1.4 RESEARCH OBJECTIVES

This thesis seeks

- To assess and adapt existing theoretical frameworks in Smart Tourism and Data Analytics for the purpose of formulating tailored frameworks capable of addressing the distinct needs and challenges inherent in the implementation of smart tourism in Iceland.
- To identify, analyse, and document the key obstacles hindering the practical implementation of Data Analytics in the smart tourism sector of Iceland, providing insights into their specific manifestations within the Icelandic context.
- To systematically identify and recommend actionable strategies and best practices that can effectively overcome the obstacles impeding the practical implementation of Big Data Analytics in smart tourism in Iceland.

1.5 RESEARCH QUESTIONS

Research questions are:

1. How can existing theoretical frameworks in Big Data Analytics be adapted or developed to effectively address the specific needs and challenges of implementing smart tourism in Iceland?
2. What key obstacles impede the practical implementation of Big Data Analytics in the smart tourism sector of Iceland, and how do these challenges manifest in the Icelandic context?
3. What actionable strategies and best practices can be identified to overcome the obstacles hindering the practical implementation of Big Data Analytics in the smart tourism sector in Iceland, thereby facilitating successful integration and enhancing overall efficiency?

1.6 CHAPTER SUMMARY

This chapter introduced the concept of smart tourism and its growing importance in the everchanging tourism industry. It emphasises the significance of this study in connecting the gap between the theoretical framework and practical applications of smart tourism. The study aims and objectives have been clearly defined, paving the way for the investigation of the challenges and opportunities in deploying smart tourism initiatives in Iceland. Following this introduction, Chapter 2 provides a literature review on smart tourism and the role of big data in the tourism context. Chapter 3 outlines the research methodes employed in this study, while Chapter 4 presents the findings and discusses their implications. Lastly, Chapter 5 concludes the thesis by summarising the key insights from this study, discussing their implications for both theoretical and practical application while also suggesting directions for future research.

CHAPTER 2 LITERATURE REVIEW

This literature review explores the concept of smart tourism. Examining its origins foundations and its implications on the tourism industry. The chapter is structured to provide the reader with a comprehensive grasp of smart tourism beginning with its theoretical foundations to its practical applications and challenges. Beginning with a definition of smart tourism, tracing its roots to the broader concept of smart cities and E-tourism. Following the definition, the study analyses the pivotal role of data in smart tourism. This section analyses the various types and sources of tourism data, stressing the importance of big data in extracting intelligence. The next section provides an analysis of the various dimensions of smart tourism, presenting frameworks proposed by researchers in the field. Continuing from this, the chapter addresses challenges and opportunities associated with the implementation of smart tourism initiatives. The discussion involves technological, social and governance related issues. Lastly, the study reviews the specific context of Iceland, examining its growth and strategies.

2.1 DEFINITION OF SMART TOURISM

The concept of smart tourism originated out of the idea of smart cities and E-tourism (Gretzel *et al.*, 2015; Gajdošík, 2019). Smart cities evolved as a response to the challenges brought by globalisation, population growth and the rise in data technology. This drove urban areas to explore innovative solutions to tackle various challenges. (Jasrotia and Gangotia, 2018; Otowicz, Macedo and Biz, 2022). The term “smart” has been applied to cities to describe initiatives that aim to employ technologies to optimise resources, effective and fair governance, sustainability, and strive to improve the life quality of the residents. Smart cities characteristics lie in the persistent use of technology and data to optimise resources, govern effectively, and improve the quality of life (Bibri and Krogstie, 2017). As such, the smart city concept encompasses a wide range of sectors and industries, including tourism (Guo, Liu and Chai, 2014). It is argued that the concepts of smart cities and smart tourism are associated and blend together (Khan *et al.*, 2017), helping each concept to advance (Wise and Heidari, 2019).

The term “Smart” has been used to describe advancements in technology, economy, and society that were driven by sensor-based technologies, big data, open data, connectivity methods, and information exchange. According to Höjer and Wangel (2015), the essence of smartness lies not in the advancement of individual technologies, but rather how these different technologies work together in synchronisation and with a coordinated application of said diverse technologies. In line with the previous, Harrison, Bosse and Phillips (2010) define smart as the use of operational, nearly real-time data, with the integration and dissemination of data. In order to incorporate analytics leading to optimisation, and visualisation to enhance operational decision-making.

While smart cities focus on the need of their residents, smart tourism primarily prioritises visitors/tourists (Çizel and Ajanovic, 2019). It operates as a dynamic ecosystem in which resident themselves can actively participate as experience providers. Additionally, the suppliers engaged in smart tourism are from various sectors and industries that may not necessarily stay within the boundaries of the city (Gretzel, 2018).

E-tourism is considered to be a precursor to smart tourism (Bulti, Ray and Bhuyan, 2019). E-tourism is defined as the of digitalising all managerial and business functions and services of the tourism system value chain. This shift aims to streamline processes and enhance customer experience between tourist companies and the consumers (Kazandzhieva and Santana, 2019). Femenia-Serra, Neuhofer and Ivars-Baidal (2019) argue that e-tourism primarily enables the creation of networks for the exchange of information and relationships between businesses and consumers. On the other hand, smart tourism promotes the fusion of digital infrastructures with the physical elements of a destination. In contrast to e-tourism, which is largely propelled by business interests, the development of smart tourism requires collaboration between the public and private sectors (Gretzel, 2018). Table 1 displays the differences between the two concepts.

	E-tourism	Smart Tourism
Plane	Digital	Digital AND physical
Core technology	Internet and web-based technology	Sensors, mobiles, IoT, cloud
Travel phase	Dreaming, Searching, Post-trip experience	All phases
Main ingredient	Information	Big data
Core activity	Searching, booking	Co-creation, co decision, product personalisation

Table 1 Differences between E-tourism and Smart Tourism

As noted by Gretzel, Ham and Koo (2018), smart tourism research have mainly been focused on cities, with little attention paid to smaller regions or interconnected cities. This finding highlights the bias in smart tourism within smart tourism but prompts questions about its feasibility and suitability on broader geographical scale. As a result of this metropolitan centric approach, smart tourism, inherit, inadvertently perhaps, the bias towards cities(Kitchin, 2014). This issue resulted in differentiating between smart cities and smart destinations**.** The latter concept is broader as a destination encompasses more than the city and incorporates the rural part of the destination and considers residents as well as visitors (Lee, Hunter and Chung, 2020).

As such, smart tourism combines information, communication technologies and tourism, to transforms this data into onsite experiences and business value propositions (Del Vecchio *et al.*, 2018; Gretzel, 2018). This transformation requires integrated efforts at the destination level to collect and aggregate data from various sources, and utilising advanced technologies to achieve goals (Gretzel, 2017). Lopez de Avila (2015) defines smart tourism as "the innovative tourist destination, built on an infrastructure of state-of-the-art technology guaranteeing the sustainable development of tourist areas, accessible to everyone, which facilitates the visitor's interaction with and integration into his or her surroundings, increases the quality of the experience at the destination, and improves residents' quality of life" (Lopez de Avila, 2015, p. 25).

Built upon this definition, Gretzel (2018) identified five layers ranging from the physical sensors to the tourist experience. These five layers can act as an assessment of the level of smart tourism and the starting element of an analysis of the smartness of the Icelandic destination. In addition to these layers other dimensions have been identified, ICT, people (identified as knowledge, human capital and experience), and leadership (meant as governmental policies, policies and digital advancement), these extra dimensions enhance this Gretzel's framework to create a bigger picture, the smart tourism ecosystem (Buhalis and Amaranggana, 2015; Otowicz, Macedo and Biz, 2022; Ndou, Hysa and Maruccia, 2023).

Smart Tourism cannot be seen as the mere integration of technology into the tourism industry, rather it stresses the need to focus on future development and implementing strategies and value creation (Gretzel, Sigala, *et al.*, 2015; Otowicz, Macedo and Biz, 2022). While smart tourism has become a fashionable term and with uptick of research in the last years (Li *et al.*, 2018), the concept of smart has been argued as indistinct and weakly defined due to its more than vague digital nature (Ren, 2018). It has been observed that a significant degree of ambiguity persists around the notion of smart tourism within academic research, corporate environments, and governmental sectors, due to the wide range of interpretations used (Li *et al.*, 2017; Park, 2021).

The lack of consensus on the concept of smart tourism has been attributed to the use of the term "intelligent tourism" as synonym (Xiaojing, 2017). However, Li *et al.* (2017) argued that there are distinctions between smart and intelligent where the former emphasise on predicting needs and technological outcomes for individuals while the latter is based in the practical application of knowledge and information.

While smart tourism is a mindset aimed at the growth and management of tourist destinations, it transcends the mere digitalisation of tasks and business functions. Unlike e-tourism, which relies on ICT for digital services, smart tourism aims to blend the physical and digital worlds via advanced technologies and the Internet of Things (IoT). This fusion enables the gathering of real-time data, enhanced interactivity, and personalised experiences (Del Vecchio *et al.*, 2018; Del Vecchio, Secundo and Passiante, 2018).

Smart tourism is characterised by the use of data analytics and big data to create responsive and adaptive tourist environments. This approach enables destinations to offer tailored experiences, improve operational efficiency, and promote sustainable practices (Lee, Hunter and Chung, 2020). For instance, smart city initiatives can use GPS system, smart transportation, and personalised travel recommendations to tailor the needs of the city, visitors and residents. Smart tourism's benefits extend to all stakeholders, tourists who enjoy more convenient and more enriching experiences, businesses can optimise their operations and marketing strategies, governments can achieve better resource management and sustainability goals. However, implementing smart tourism initiatives also presents challenges, such as safeguarding data privacy and overcoming technological barriers.

In conclusion, smart tourism represents a holistic approach to destination management and growth. By combining cutting-edge technologies to blend the physical and digital realms, It offers significant benefits in terms of personalisation, efficiency, and sustainability, distinguishing itself from traditional e-tourism.

2.2 DATA FOR TOURISM

The use of data in the tourism industry is a crucial faction in fostering its intelligent development (Li *et al.*, 2018). Indeed, the effective use of data presents a wide range of opportunities for enhancing tourism services at both the destination and company level (Sigala, Rahimi and Thelwall, 2019). Numerous studies have highlighted examples, such as personalised marketing campaigns using location information shared by users on social media (Salas-Olmedo *et al.*, 2018). The use of historical data to optimise operational planning (Ardito *et al.*, 2019). These instances showcase the the increasing trend of data-driven strategies in the tourism sector. Both public authorities and private sector entities are actively embracing smart data utilisation. A notable trend in this domain involves accommodation booking platforms that gather, merge, modelise and analyse various data types and sources of data to provide hosts with optimal rental prices (Such-Devesa *et al.*, 2021). This development coincides with the overall shift towards the creation of datasets and data analytics models that promote data

interoperability and the standardisation of formats, enabling the analysis of vast amounts of data that were previously unimaginable (Salas-Olmedo *et al.*, 2018).

To leverage the potential of multiple data sources in tourism, it is crucial to map the smart tourism ecosystem (Shoval and Ahas, 2016; Li *et al.*, 2017; Xiang and Fesenmaier, 2017; Sigala, Rahimi and Thelwall, 2019; Otowicz, Macedo and Biz, 2022) This process includes the following important elements:

- Purpose: Defining the purposes for which data can be collected and analysed.
- Stakeholders: Identifying all the main stakeholders, including data users and producers.
- Data Types and Sources: Categorising the available data types identifying the main sources possible for these datasets.

These dimensions form the foundation for identifying potential data flows and valuable datasets that smart destinations might already possess but are not yet fully utilising. It is imperative to adhere to the who, what, and where of data needs to ensure comprehensive and effective data usage.

However, data quality varies, and it is crucial to employ frameworks to assess and evaluate the quality and relevance of data. Frameworks of selection have been proposed by Stróżyna *et a*l (2018) for open data. High-quality data can significantly enhance decision-making processes, while low quality data results in poor results.

2.2.1 Purpose areas of data use

Destinations aiming to use data to enhance their services must clearly define and understand the objectives of the data collection and data analytics efforts (Benoit, Lessmann and Verbeke, 2020). Research has identified several key areas where data can be used effectively, as outlined in table 2 (Del Vecchio *et al.*, 2018; Mariani, 2019; Galasso *et al.*, 2022; Lyu *et al.*, 2022)

The first element concerns enhancing the tourist destination interaction through personalised and tailored services. Secondly, advancement in data access analytical capabilities have improved market analysis and decision-making processes. While private and public sectors engage in data collection, public authorities typically possess

information on local services interaction (such as mobility) where private entities have access to behavioural data enriched by market dynamics.

Goal	Description
Enhance tourist interactions	Utilise data to improve tourism services through personalisation and increased engagement with tourists. Leverage new technologies and analytics to optimise and tailor offers to individual preferences. Address modern tourists' expectations for customised experiences, which are crucial for satisfaction and destination quality perception.
Improve market analysis and decision-making	Enhance strategic planning through advanced data analytics capabilities. Utilise data from both public and private stakeholders to inform business strategies and manage tourism flows. Combine public data on visitor interactions with local services and private sector data on commercial and behavioural patterns.
Improve planning or operations	Leverage data to forecast tourism patterns, improving efficiency and competitiveness through precise resource allocation. Expand tourism data sources to gain insights into visitor flows and preferences, enabling timely adjustments to activities, promotions, and resource deployment.
Enhance destination sustainability and accessibility	Improve the relationship between tourism and the local environment through data-driven management. Develop targeted services for disadvantaged groups and improve accessibility of existing offerings. Implement smart solutions to enhance overall efficiency of the tourism ecosystem, promoting transparency and inclusivity in local communities

Table 2 Goals of Smart Tourism (Del Vecchio et al.*, 2018; Mariani, 2019; Galasso* et al.*, 2022; Lyu* et al.*, 2022)*

Thirdly, the use of data can aid in understanding and forecasting tourism patterns, contributing to more efficient resource allocation. By diversifying the sources of data,

stakeholders can identify trends and respond quickly to changes. Finally, comprehensive destination data analysis can enhance the overall environment, impacting society at large. Strategic management and analysis can lead to improved experiences, both for residents and visitors.

2.2.2 Type of data users

As theorised by Buhalis and Amaranggana, (2015), smart tourism evolved as an ecosystem where destinations stakeholders are intertwined and create and exchange data and information. This idea is supported by Gretzel, *et al.* (2015), adding that this ecosystem is in strong contrast to previous views, such as Werthner's (2003) top-down approach. This smart destination ecosystem blurs the line of who is a producer and consumer of data and removes this hierarchical aspect. This ecosystem recognises three main data users: tourism destination and public authorities, private sectors of the tourism industry and other industries.

2.2.3 Source and type of data

The source of the data stream defines the type of data itself. The literature has identified three type of data sources with subcategories. Figure 1 provides a condensed review (Xiang and Fesenmaier, 2017; Li *et al.*, 2018; Lyu *et al.*, 2022).

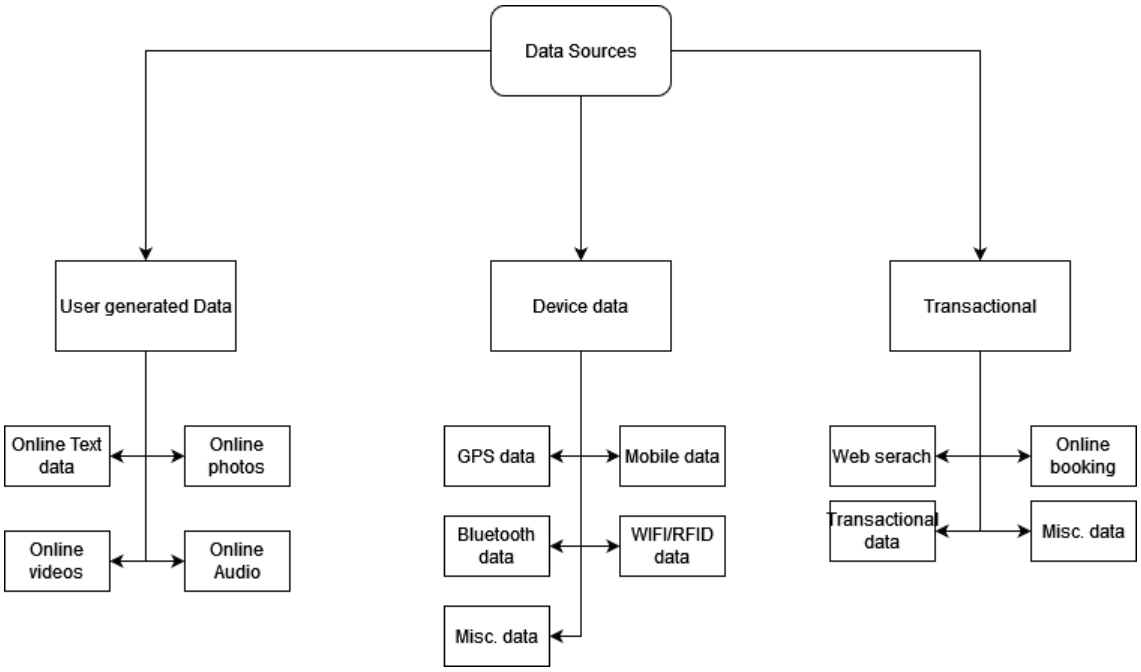

Figure 1 - Sources and Types for data adapted from (Lyu et al.*, 2022)*

Research and reviews have discussed the potential issues with the acquisition and use of these datasets, while most of the literature is using User Generated Content (UGC) for analysis (Li *et al.*, 2018; Lyu *et al.*, 2022). However, potentially due to its low cost of acquisition and ease of access (Lyu *et al.*, 2022), it has been argued that such data is not representative of the actual tourist's voice (Mariani, 2019).

Despite the potential of big data, challenges exist in selecting suitable sources and questioning whether the data is "big" enough (Sigala, Rahimi and Thelwall, 2019; Stylos and Zwiegelaar, 2019). The scope of information that destination can potentially access is larger and continues to grow. The term "big data" itself refers to a collection of information of such magnitude that conventional systems require substantial time and resources for analysis (Gandomi and Haider, 2015). The data collected can either be of structured or unstructured format, complicating the analysis. The characteristics of big data, often represented by the three Vs (Volume, Velocity, Variety), have evolved with some studies, identifying up to ten Vs (Al-Mekhlal and Ali Khwaja, 2019).

2.3 DIMENSIONS OF SMART TOURISM

Understanding smart tourism extends beyond its mere toylike technological aspects, it requires an investigation into its multidimensional nature. Within these dimensions, lies various facets that shape the overall framework of smart tourism. Dimensions in smart tourism represent diverse elements shaping its scope, ranging from technological infrastructure to socio-economic and environmental considerations. By exploring these dimensions, we gain insight into the complexities and interdependencies inherent in smart tourism development.

The dimensions of smart tourism have been extensively analysed and discussed since the early identification of four key dimensions by Boes, Buhalis, and Inversini (2015). These dimensions can be viewed through different lenses depending on the perspective taken, whether it be the tourist perspective (Gajdošík, 2019b), the business perspective (Gretzel, Werthner, et al., 2015), or the destination perspective (Gajdošík, 2019a). While these four dimensions have been expanded upon in subsequent research, the core themes remain consistent, though under evolving terminologies. These themes include a broad definition of IT and digitalisation, an overlap between entrepreneurship, digital innovation, a strong emphasis on sustainability and user experience, and a limited focus on human skills (Boes, Buhalis and Inversini, 2015; European Commission *et al.*, 2022; Sorokina *et al.*, 2022).

Building on an iterative review, Otowicz, Macedo, and Biz (2022) propose a more granular map of these dimensions. This detailed approach addresses some of the ambiguities and overlaps identified in previous frameworks. Table 3 presents an integrated overview of these dimensions, mapped against Gretzel's (2018) five-layer concept, highlighting both commonalities and distinctions in their conceptualisation.

Gretzel's 5 Layers	Otowicz	Boes	European Commission	Sorokina
Physical	Technology		Digitalisation	IT
Technology	Human capital, Innovation MGT	Entrepreneurship and Innovation	Digitalisation	IT
Data	Knowledge MGT, Collaboration,	Social Capital, Leadership	Digitalisation	IT
Business	Marketing, Transparency, Governance,	Human Capital		E-governance
Experience	Suitability, Experience, Accessibility, customised services, Safety, Mobility	Tourism experience	Creativity and cultural heritage, Sustainability, Accessibility	Sustainability, Liveability

Table 3 Dimensions of Smart Tourism (Adapted from Boes, Buhalis and Inversini, 2015; Gretzel, Werthner, et al.*, 2015; Galasso* et al.*, 2022; Otowicz, Macedo and Biz, 2022; Sorokina* et al.*, 2022)*

2.4 THEORETICAL FRAMEWORKS FOR SMART TOURISM

Various frameworks have been developed over time to encompass the many aspects of the smart tourism ecosystem. Prominent frameworks include the five pillars proposed by the European Commission (European Commission et al., 2022), TOMI (Moustaka et al., 2019), the five layers framework (Gretzel et al., 2015), and the (SA) 6 framework (Tran, Huertas, and Moreno, 2017). These frameworks offer diverse perspectives and methodologies for understanding and developing smart tourism destinations. It has been noted, however, that articles and studies focus on fitting the existing smart tourism ecosystem concept into existing frameworks or generating models that are either purely theorical or drawn from individual case studies (Shafiee *et al.*, 2022). Additionally, it is pointed out that a majority of said studies focus more on developing a model than exploring the diverse factors that contribute to the development of smart tourism destination (Shafiee *et al.*, 2022).

The application of these frameworks varies widely, depending on the specific goals and contexts of their implementation. For example, the European Commission's the five pillars framework aims to offer an approach to create a smart destination by focusing on digital transformation, sustainability and governance (Galasso *et al.*, 2022). This

framework has been adopted across the European unions in various cities to improve their tourism infrastructure and services.

The TOMI framework (Tourism-Oriented Management Information) aims to incorporate advanced information systems to manage tourism activities effectively (Moustaka *et al.*, 2019). It has been implemented in several pilot projects, demonstrating its potential to improve decision-making processes and increase visitor experiences through real-time data analytics and smart technologies.

Gretzel et al. (2015) introduced a layered approach, following closely the OSI framework, to understand smart tourism. Like the OSI framework, it includes layers built on top of another, it includes physical, digital, human, business, and social layers. This framework, while not as in depth as the other mentioned frameworks, has been used to analyse the relationships amongst different components. This aims to reveal the network of how various factors interact to create an holistic view of the smart destinations.

The (SA)6 framework is another notable model that focuses on six key dimensions: Smart governance, Smart economy, Smart mobility, Smart environment, Smart people, and Smart living (Tran, Huertas and Moreno, 2017). Several cities in Spain have used this framework to evaluate the smartness of the destination, this framework offers a structured approach to gauge the actual capacities.

2.4.1 Limitations of Frameworks

Although widely used, these frameworks have limitations. A common critique is the tendency to be lean heavily on theory making and conceptual approach, making it difficult to apply them in practical situations (Shafiee *et al.*, 2019). For instance, the European Commission five pillars framework provides the theoretical foundations, its implementation can be posing challenges due to the substantial resources and collaboration required amongst stakeholders.

Another limitation is the tendency of these frameworks to focus on specific aspects of smart tourism while neglecting others (Sorokina *et al.*, 2022; Ndou, Hysa and Maruccia, 2023). For example, the TOMI framework stress information management but

overlook other crucial factors such as skills and local community involvement. Similarly, Gretzel's five layers framework, while comprehensive, is difficult to implement due to the high-level view of the ecosystem and the need for extensive data integration across the different layers. The (SA)6 framework, although robust, does not completely capture the features of different tourism destinations, resulting in a uniform, one-size-fits-all approach, that may not be effective in every situation. As mentioned above, frameworks tend to be created out of a case study from a single destination, limiting the generalisation to a broader context.

2.4.2 Proposing a Synthesised Framework

To attempt to overcome these limitations and improve upon existing models, a synthesised framework that leverage the strengths of existing models while mitigating their weaknesses is proposed. This new framework would combine the comprehensive approach of EU commission five pillars with the practical approach of TOMI and the layered perspective of Gretzel's five layers framework (2015). Furthermore, the incorporation of the six dimensions outlined in the (SA)6 framework ensure a holistic evaluation of smart tourism destinations.. Table 4 provides a synthesis view of this framework and its component.

Element	Description
Integrated Governance	Combining smart governance and digital transformation to ensure effective coordination and implementation of smart tourism initiatives.
Sustainable Development	Emphasising environmental sustainability and cultural preservation to balance tourism growth with the protection of local resources.
Enhanced Mobility	Leveraging smart mobility solutions to improve transportation efficiency and accessibility for tourists.
Data-Driven Decision Making	Utilising advanced information systems and real-time data analytics to inform strategic planning and operational decisions.
Community Engagement	Involving local communities in the development and management of smart tourism initiatives to ensure inclusivity and cultural relevance.
Holistic Experience	Focusing on enhancing the overall visitor experience through smart services and personalised interactions.

Table 4 Synthetised framework (Adapted from Gretzel, Werthner, et al.*, 2015; Tran, Huertas and Moreno, 2017; Moustaka* et al.*, 2019; Galasso* et al.*, 2022)*

By integrating these components, the synthesised framework aims to provide a more comprehensive and practical approach to developing smart tourism destinations, addressing the diverse needs and challenges of different contexts, while fostering

sustainable and inclusive growth. See figure 2 for a representation of this framework.

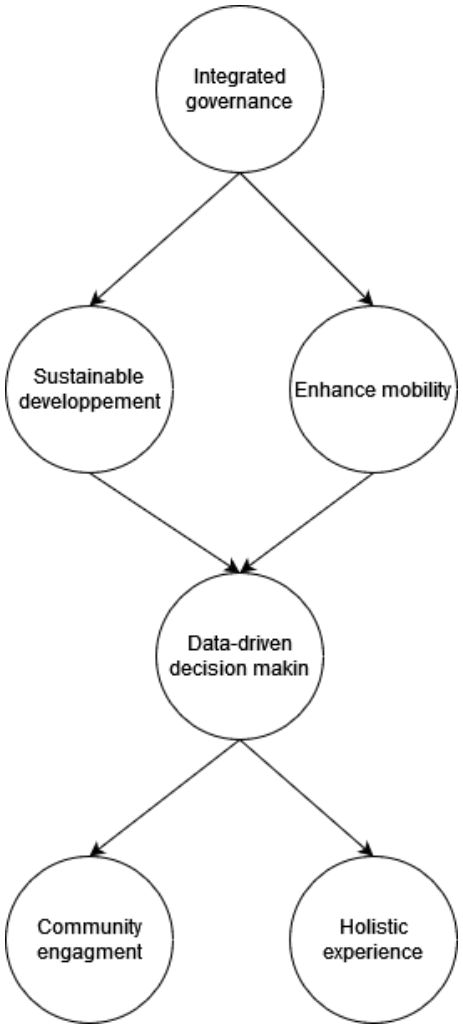

Figure 2 -Representation of the synthetised framework

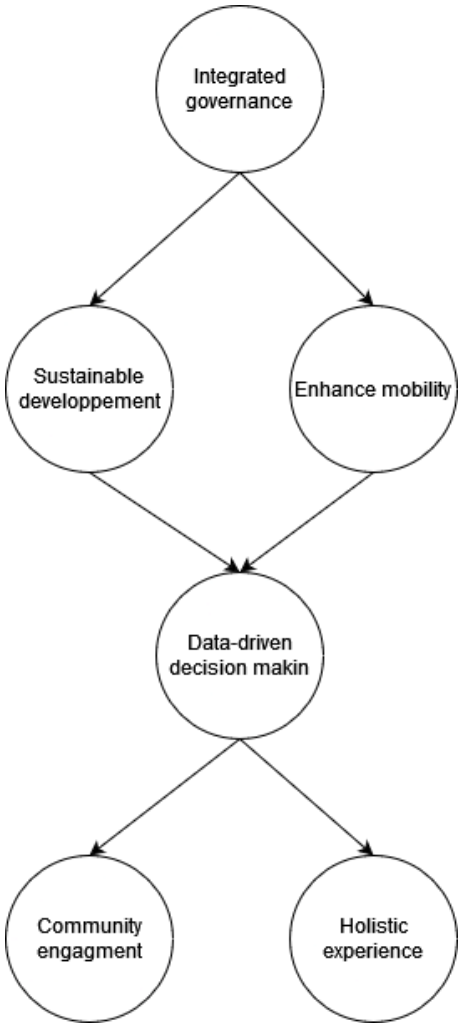

Figure 3 -Representation of the synthetised framework

2.5 CHALLENGES AND OPPORTUNITIES IN SMART TOURISM

Researchers generally agree on the benefits and possibilities that big data offers to tourism and smart tourism (Buhalis and Leung, 2018; Li *et al.*, 2018; Ardito *et al.*, 2019; Mariani, 2019; Yallop and Seraphin, 2020; Rahmadian, Feitosa and Zwitter, 2022). However, implementing these concepts comes with sets of challenges, such as the sheer quantity and the nature of the data itself and navigating the legal considerations, table 5 proposes a summary of the various challenges (Gretzel, Sigala, *et al.*, 2015; Buhalis and Leung, 2018; Gretzel, 2018; Galasso *et al.*, 2022; Lyu *et al.*, 2022; Otowicz, Macedo and Biz, 2022)**.**

Challenges	Description
Data Itself	Smart tourism requires handling various dimensions of data (the "V's"), which necessitates specialised expertise and advanced technologies. For an industry dominated by micro-businesses, such as tourism, the substantial investments required for effective data utilisation are challenging to implement.
Heterogeneity of data	The creation and use of global, national, and local tourism platforms are hindered by issues like lack of connectivity and standardised formats. These well-known challenges of large-scale data utilisation impede seamless data sharing and platform interoperability
Technology and Power	Effective smart tourism solutions depend on an extensive network of information and communication infrastructures, necessitating significant investments. Continuous power access for all stakeholders is essential, posing technical and sustainability challenges.
Tourist attitude and digital literacy	While smart tourism solutions offer personalised experiences, not all tourists prefer these over traditional ones. Engagement with smart solutions can cause cognitive overload, and varying levels of digital literacy and access to devices among tourists can lead to exclusion from smart experiences.
Privacy	Smart tourism relies heavily on the acquisition and use of tourists' personal data to enhance experiences. Despite increasing privacy concerns, particularly after GDPR, tourists are generally more willing to share personal data in tourism contexts compared to everyday scenarios.
Governance and Cooperation	Successful smart tourism requires the collective effort and resources of various stakeholders. Key to this success is the presence of a critical mass of stakeholders who are aware of smart tourism benefits, trust each other, and are committed to shared goals. Achieving seamless collaboration, data exchange, and alignment of objectives is a significant challenge for destinations.

Table 5 Challenges in Smart Tourism (Adapted from Del Vecchio et al.*, 2018; Li* et al.*, 2018; Ardito* et al.*, 2019; Stylos and Zwiegelaar, 2019; Benoit, Lessmann and Verbeke, 2020; Belias* et al.*, 2021; Mariani and Baggio, 2021)*

The problem of big data analytics has been identified by the literature; the absence of theoretical frameworks has been noted (Li *et al.*, 2018; Ardito *et al.*, 2019; Mariani and Baggio, 2021). The absence of frameworks can be attributed to a limited comprehension of technology and data analytics by tourism professionals (Ardito *et al.*, 2019; Benoit, Lessmann and Verbeke, 2020; Mariani and Baggio, 2021). Connected with this element, a focus on simple descriptive analytics based on a singular dataset

for acadmecis (Secundo *et al.*, 2017; Del Vecchio, Secundo and Passiante, 2018; Li *et al.*, 2018; Mariani and Baggio, 2021).

Despite the increasing popularity of big data analytics in tourism, there is a noted gap between theory and implementation that has been noted by academics (Li *et al.*, 2018; Ardito *et al.*, 2019; Stylos and Zwiegelaar, 2019; Benoit, Lessmann and Verbeke, 2020). While it is argued that big data analytics is a growing and promising field (Li *et al.*, 2018), others acknowledge that the real implementation and value extraction remain limited to theoretical discussions or a few exemplary cases (Ardito *et al.*, 2019). This gap is further worsened by a lack of knowledge and understanding among professionals in the tourism industry (Belias *et al.*, 2021), highlighting the important need for a cultural shift in companies willing to embrace big data (Stylos and Zwiegelaar, 2019).

2.6 SMART TOURISM IN ICELAND

Tourism in Iceland has witnessed remarkable growth in the last 15 years, experiencing a fivefold rise between 2000 and 2023 from roughly 450’000 visitors to 2.2 million (Statistics Iceland, 2023). This surge is particularly noteworthy as the current yearly number of visitors surpasses the local population more than five times (Statistics Iceland, 2023).The Icelandic parliament, recognising the importance of sustainable development t outlined a tourism strategy for 2011-2030. This plan focuses on increasing the profitability, developing tourist destinations systematically, enhancing professionalism, and preserve Iceland's distinctiveness as a tourist destination (Althingi, 2011). The latest version of’ Iceland's tourism strategy, from 2020 to 2030, highlights the goals of achieving a profitable and competitive tourism industry in harmony with the nation and its population (Althingi, 2024). The focus is on improving the overall visitor experience, enhancing residents’ life quality, promote data-driven decision making and achieve sustainable outcomes.

The organisation of the tourism industry is decentralised. Ferðamalastófa, the Icelandic Tourist Board, is a government agency, operating under the Ministry of Culture and Business affairs and has, amongst others, the following missions (Althingi, 2024):

- Implementation of tourism policy, planning and support for regional development
- Collection, dissemination and processing of information, including statistical data and other information
- Analysis of the need for research, including useful information for government policy making, in cooperation with the industry and research institutes in the field of tourism.

Working alongside the Icelandic Tourist Board are the regional DMOs. These entities are registered as non-profit entities engaged in business activities. They receive their funding from the state of Iceland, municipalities and willing participating companies.

2.7 CHAPTER SUMMARY

This chapter provided a literature review on smart tourism and the role and impact of big data in the tourism context. Beginning by defining smart tourism and tracing its origins to the wider concept of smart urban aeras and E-tourism, it analyses its key features and dimensions. It then outlined the categories and types of tourism data with a focus on the importance of extracting insights and value. The chapter presented an analysis and evaluation of smart tourism frameworks, highlighting their strengths and weaknesses. Finally, it contextualises smart tourism with the Icelandic landscape.

CHAPTER 3 RESEARCH METHODOLOGY

The following chapter describes the methodology and research design of this thesis. It begins by discussing the research philosophy, followed by the research design, data collection methods and data analysis techniques. The chapter continues explaining the qualitative approach undertook, and how the grounded theory methodology is used. Closing, the final section examines the ethical concerns and a summary of the process.

3.1 RESEARCH PHILOSOPHY

According to Willis (2007), interpretivism aims to comprehend specific context with the core belief that societal interactions shape reality. Kivunja and Kuyini (2017) describe interpretivism essential features, which emphasises the importance of context, multiple realities, and the interdependence of causes and effects. This aligns perfectly with the complex and multifaceted nature of smart tourism implementation, where stakeholders' perspectives and contextual factors play crucial roles. By focusing on interpretations rather than objective truths, interpretivism allows for a nuanced exploration of the complexities inherent in smart tourism, enabling the study to discover insights that may not be readily apparent through other quantitative methods.

3.2 RESEARCH DESIGN

In this study, a qualitative research design was adopted. Qualitative methods help us discover the meaning of events as they are experienced by people (Merriam and Tisdell, 2015). As smart tourism is a complex and multifaced aspect phenomenon and given that stakeholders face various challenges, using qualitative methods allows the flexibility needed to explore the nuances and identify specific issues (Saunders, Lewis and Thornhill, 2007). This method, allows for a nuanced understanding of the bedrock of smart tourism in the absence of predefined frameworks. The absence of of a single definition and single approach to smart tourism makes a deductive approach

impossible (Bengtsson, 2016). Instead, an inductive approach is employed, aligning with the grounded theory methodology described below.

3.3 RESEARCH STRATEGY

Grounded theory was chosen as the research method for this study due to its suitability for generating theory, particularly in under-researched areas. This approach enables the development of theories by analysing data collected from participants. Following an inductive approach that let the data "speak for itself" without influences from existing theories or the researcher's preconceptions.

The justification for employing a grounded theory approach is its capacity to investigate and explore phenomes thoroughly, especially when little research (Chun Tie, Birks and Francis, 2019). Through continuously comparison and data analysis, grounded theory helps uncovering patterns and themes that emerge from the data, leading to the development of theory-based or concept-centric ideas.

3.4 DATA COLLECTION METHODS

In order to gather data for this study, semi-structed open ended interviews were conducted with stakeholders of the smart tourism industry in Iceland. This method enables participants to freely share their views and perspectives, providing rich and comprehensive data. The interviews were structured around Gretzel ‘s five-layer concept (2017). These layers cover the physical, technological, data, business and experience aspects. This framework allowed for a comprehensive exploration of the participants’ perspective without limiting answers to a specific framework and identifying pain points.

3.4.1 Sample and population

The study focuses on managers in the smart tourism ecosystem in Iceland. This ecosystem has an estimated population of 200 stakeholders. This figure was estimated by assessing organisation such as DMOs, travel technology companies and government

bodies involved in tourism data, and considering Iceland's population. A purposive sampling method was used to choose participants.

The target sample size was determined following recommendations for grounded theory studies which suggest 15 interviews to reach theoretical saturation (Creswell and Poth, 2016). Due to the specialised nature of this field and the Iceland's small population, the actual sample size reached was 8 participants. This number, while smaller than initially planned, yet is still considered adequate for qualitative studies focused on insights rather than statistical representation (Braun and Clarke, 2021). Participants were deliberately selected for their relevant position and expertise to bring diverse and insightful perspectives to the study. This sampling methods allows for the selection of individuals who can provide valuable perspectives into the research topic (Charmaz, 2006).

3.4.2 Procedure

Interviews took place from February 2024 and June 2024. Participants were recruited though email and Linkedin. Selected and interested participants received an email detailing the research objectives and inviting them to take part to the study. Each participant was provided with a personal information sheet and consent form seeking permission for recording the interview. One hour interview sessions were arranged. The interviews followed a semi-structured open-ended approach, allowing the flexibility to cover interesting topics while ensuring key dimensions were addressed. A pilot test was conducted with the first interview to check with the clarity and relevance of the questions. Based on the feedback from the initial interview, minor rephrasing of questions and extra prompts were introduced to encore more in depth answers. All participants had to sign an informed consent form to consent to the participation and being recorded. Moreover, they were verbally informed about the beginning of the recording.

3.5 DATA ANALYSIS METHODS

This study used a grounded theory approach to data analysis, following the framework outlined by Chun Tie, Birks and Francis (2019). This approach is consistent with the broader principal of grounded theory principles established by Glaser and Strauss (1968) which were later expanded by Charmaz (2006). The analysis procedure was carried out in series of phases: open, axial, and selective coding.

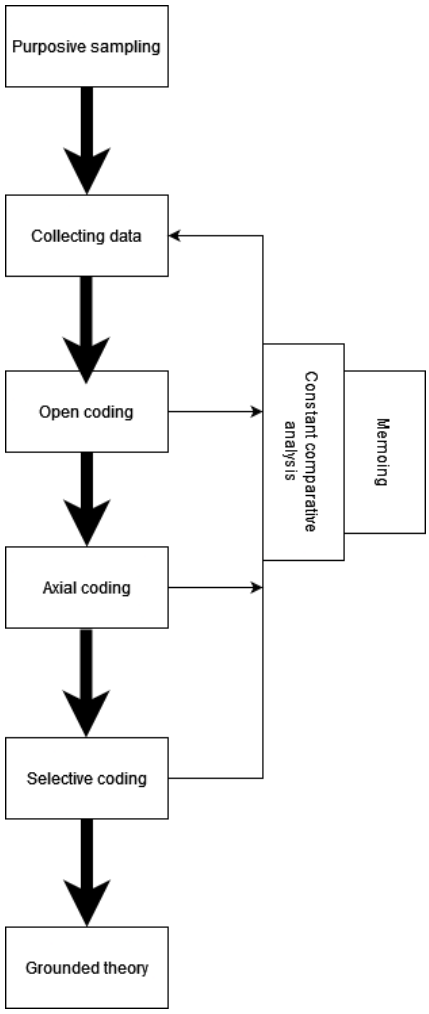

Figure 4 - Research framework

Open coding involves breaking down the raw data from the interviews into discrete parts, examining each segment for meaning and identifying concepts and categories. Following open coding, axial coding is used to identify relationships amongst the codes identified in the open coding phase. This axial coding phase reassembles the data in new ways by making connections between a category and its subcategories. The goal is to refine the categories and develop a more coherent structure. Lastly, selective

coding, the last stage, identifies the central phenomenon which englobes all other categories. This stage involves selecting the core category and connect them to other categories. validating those relationships and filling in categories that need further refinement and development.

Throughout the analysis, the data was constantly compared with new data existing and emerging. This iterative process helped refine the emerging theoretical framework and ensure it remained grounded in the data. Theoretical sampling guided further data collection, with gaps in the data identified and addressed through additional targeted interviews. This process continued until theoretical saturation was reached, indicating no new significant insights were emerging from the data.

3.6 ETHICAL RESEARCH PRACTICES

This study was conducted in accordance with the ethical guidelines provided by the University of Cumbria. All participants were provided with an information sheet detailing the study's purpose, their role and how their data would be used. Written informed consent was obtained from each participant before the interview. To protect participants identities, all personal identifiers were removed from the data during the transcription process. Numbers were used in the reporting of the findings. All interviews' recordings and transcripts were stored securely on password protected devices. Participants were informed of their rights to withdraw from the study.

3.7 CHAPTER SUMMARY

This study uses a qualitative research design supported by an interpretivist philosophy and a grounded theory approach. Data were collected through semi-structured interviews with key stakeholders in Iceland's tourism industry sampled purposively. The data were analysed through a three-stage process following the grounded theory framework. By using this methodology, this study aims to contribute to the theoretical understanding of smart tourism implementation and to provide insights for stakeholders in the Icelandic tourism industry.

CHAPTER 4 FINDINGS

4.1 INTRODUCTION

This chapter presents the findings from the analysis of interviews with stakeholders in Iceland's tourism industry. Following an inductive grounded theory approach, the goal was to explore the state of smart tourism in Iceland and how it is currently implemented. Through coding and analysis, several themes that emerged from the data were identified, generating a core category capturing the central phenomenon.

4.2 PARTICIPANT DEMOGRAPHICS

The research included a diverse group of 8 participants, all professionals in the Icelandic tourism industry in roles such as project manager, product manager and DMO. Out of the 8 participants, seven were women and one was a man. Table 6 provides an overview of the participants.

The interviews were conducted over a period of five months, from February 2024 to June 2024. They happened either face to face, at the participant's workplace or via video conference such as Teams. The interviews lasted between 60 to 180 minutes allowing for a proper coverage of the topics.

Interviewee	Title	Organisation
Participant #1	Traveltech Consultant	Private industry – Non direct travel
Participant #2	Product Manager	Private industry – Direct travel
Participant #3	Project Manager	Destination Management Organisation
Participant #4	Managing Director	Destination Management Organisation
Participant #5	Managing Director	Destination Management Organisation
Participant #6	Project Manager	Destination Management Organisation
Participant #7	Research Manager	Government organisation – Statistical Office
Participant #8	Managing Director	City Organisation – tourism related

Table 6 Overview of the participants

4.3 OVERVIEW OF GROUNDED THEORY PROCESS

4.3.1 Data collection

Data collection followed the principles of grounded theory which emphasises a systemic and consistent approach. Interviews were conducted using a semi-structured approach ensuring key topics were addressed while allowing flexibility to explore new themes as they come. A pilot test with the first participant allow for the refined the interview questions and added clearer prompts. As categories began to emerge, the semi-structured format allowed for deeper exploration within the framework. This allowed to maintain consistency across all interviews while respecting the iterative nature of grounded theory.

4.3.2 Data analysis

Coding is an essential part of a grounded theory approach (Charmaz, 2006) and is the analytical process to identify concepts and similar occurrences in data (Chun Tie, Birks and Francis, 2019). Coding serves as the bridge connecting data with the formulation of a coherent theory that describes the data. The first step of the data analysis was to code the interviews, where the data was broken down into discrete parts and examined for meaning. This process involved a sentence-by-sentence coding of interview transcripts to identify concepts.

Following open coding, the axial coding phase begun. This step proceeded to identify relationships between the identified open codes. At this stage, the open codes were reassembled into categories by making connections between categories and subcategories.

Lastly, categories were integrated and refined to form a coherent theoretical framework. This process, selective coding, involved identifying the central phenomenon and systematically relating it to other categories. Selective coding plays a role in crafting a narrative that explained the core theme observed in the data.

4.4 EMERGENT THEMES AND CATEGORIES

The analysis uncoverd six distinct yet interconnected themes. In the following section, each theme will be discussed in depth, exploring its emergence from the initial code and its role in the wider data landscape. Table 7 shows the themes that emerged, including their frequency. A more detailed version is available in the appendix 5.

Theme	Frequency %	Category	Frequency
Data Ecosystem	35%	Data Infrastructure	12.5 %
		Data Quality	11.5 %
		Data Collection	11.5 %
Organisational Readiness	27.5%	Resource Constraints	10 %
		Skill Deficiency	8.75 %
		Strategic Alignment	8.75 %
Human Capital	16.25%	Workforce Development	8.75 %
		Cultural Shift	7.5 %
Implementation Obstacles	13.75%	Regulatory Challenges	6.25 %
		Collaboration Barriers	7.5 %
Leadership and Strategy	7.5%	Vision and Direction	3.75 %
		Leadership	2.5 %
		Change Management	1.25 %

Table 7 Themes and categories

In the following, the emergent themes will be discussed separately in more detail.

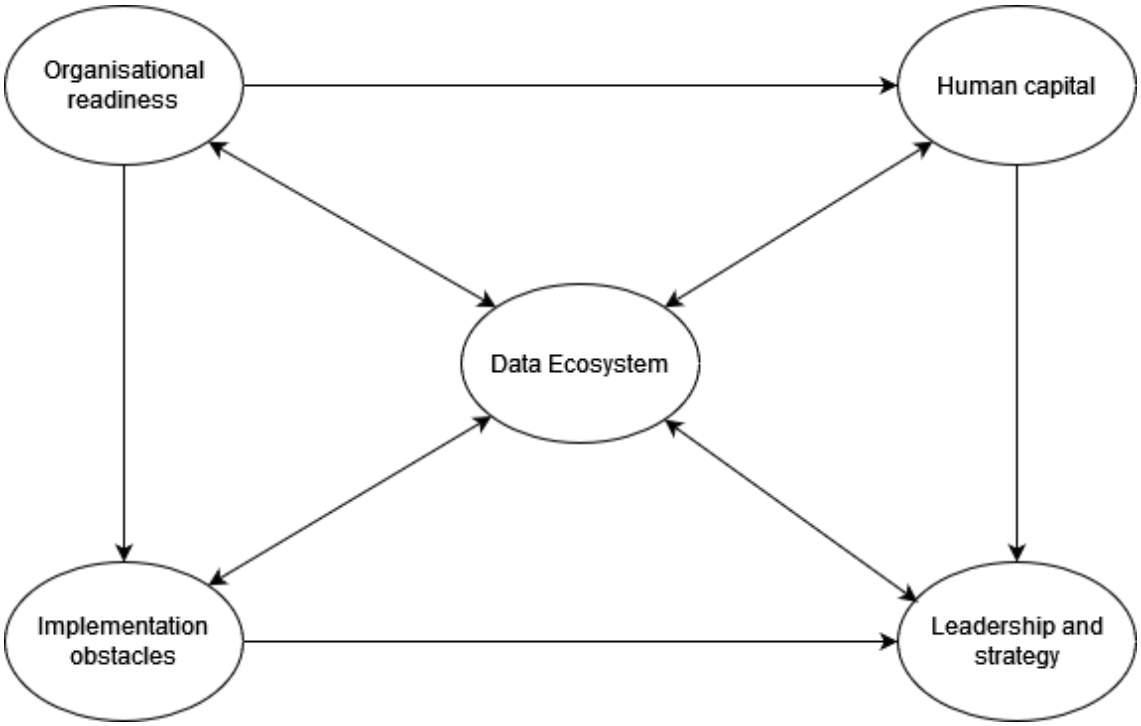

Figure 5 - Representation of the theme's interconnection

4.4.1 Theme 1: Data Ecosystem

This theme of Data Ecosystem encompasses all aspects of the tourism data stack. The theme is complex and includes codes such as data collection, quality of collected information and how data is used. The data ecosystem is the foundation on which smart tourism happens, it constitute a vital element enabling it. In the Icelandic context, the data ecosystem appears to be in its very early stages facing notable obstacles across all aspects.

4.4.1.1 Sub theme 1: Data infrastructure

This current status of data maturity and infrastructure is a main challenges in Iceland's tourism sector. Seven participants raised concerns about the lack of sophisticated data collection and analysis systems. Accessing and using existing data not in their organisation is always difficult, when feasible. The interconnection of these codes was evident as issues in one area, for instance data collection, often had repercussions in others, data quality for example. Participant #3 highlighted this issue as follows:

"We are not very mature in the data work here in the region and the reason is mainly because we don't have the funding to do whatever we would like to do. But data is very important for us because we need to base our decisions on data behaviour of tourism."

This quote underscores two critical aspects: the recognition of data's importance and the lack of resources to fully leverage it. The same interviewee further elaborates on the challenges:

"It's still in Excel sheets in [Icelandic Statistical Office], it's not Smart data. So yeah, so a lot of these [data] are difficult to get."

At the same time, participant #7 does not agree with the above statement and brings about the fact that the statistical office does offer extended technical connection such as an API access, python packages and a web interface and points this view to a lack of skill, as pointed out below:

We need to enhance this understanding because we cannot have a resource, you know, use a resource that we do not understand. I do not feel sorry for the businesspeople or anybody… It's the same way with a fish. You need to know how to work the fish if you're going to sell it.

The infrastructure challenges extend beyond just data management systems. Participant #8 points out, speaking about the digitalisation of a municipality, the disregard for such initiatives.

"There was no infrastructure, no. There was no data pool. There was no data warehouse. The data pipes were all broken or not, not even broken. They were just non-existent."

This stark assessment reveals the fundamental infrastructure gaps that need to be addressed before more advanced smart tourism initiatives can be implemented.

4.4.1.2 Sub theme 2: Data collection

Data collection processes are often manual and inconsistent. This issue leads to constant issues regarding the trust in data and measuring results. While organisations are collecting data, they struggle to effectively utilise it. This generates a rift between

data acquisition and effective insights, not to speak of actionable elements. Participant #3 shares an anecdote of data collecting devices breaking down without anyone being notified or even noticing. The last sentence depicts the byzantine bureaucratic labyrinth of the Icelandic administration:

> *We have a scanner that counts people that goes to [place] and then goes to [another place]. Both of them malfunctioned this year. I lost data, I lost the year's data in counting people. And I've been pushing for them to fix it. I push, the tourist board and the tourist board push the environmental agency.*

Without reliable data that is both comprehensive and readily accessible, it is challenging to make data-driven decisions or set up any kind of analytics. An immature data ecosystem is a large obstacle for the implementation of smart tourism projects.

4.4.1.3 Sub theme 3: Data quality

The trust in data quality, even their own is always questioned. Participant #6 explains how at one location, there are two different ways of counting visitors, using two different methods from two different organizations, and they give completely different results. Participant #6 gives the example of how the Icelandic Tourist Board (Ferðamálstofa) did not integrate the number of NATO personal in the visitors flow yet integrated their spendings, skewing the averaging spending of the region. In this example, the NATO personal is not passing through the general gates of the airport and not counted as passengers by airport authorities. Participant #6 adds:

> *But [Ferðamalstofa] would never realise that unless they called us and asked, you know, there is some regional knowledge.*

4.4.1.4 Sub theme 4: Lack of standardised data formats and interoperability

The absence of a standardised framework in data capture or storage, presents deep issues when trying to combine data from various origins. This is restricting the scope for any analysis and valuable findings. The obstacles associated with unifying data structures, ensuring compatibility, and managing privacy issues may be perceived as openings for the sector to collaborate, devise collective remedies, and institute

optimal procedures that have the potential to position Iceland at the forefront of intelligent tourism deployment.

4.4.2 Theme 2: Organisational readiness and resources constraints

The Organisational Readiness theme captures the internal barriers organisations face in adopting smart tourism initiatives.

4.4.2.1 Sub theme 1: Resource Constraints

In the Icelandic tourism landscape, organisational readiness appears to be a significant challenge, largely due to the predominance of small and micro-sized businesses. The limited size of many tourism operators impacts their ability to invest in and implement smart tourism initiatives. These smaller companies often lack the financial resources, manpower, and specialised expertise required to adopt advanced data-driven approaches. All interviewees cited limited budgets and lack of personnel as major obstacles to implementing smart tourism initiatives. The tourism industry in Iceland, despite its importance to the economy, seems to be underfunded in terms of technological and data-driven initiatives. Participant #6 stated:

> *" And you know, we simply don't have the time. And we also don't have the money for it because we could hire another person. We don't have the capacity. […] We are working with so little money for each year, we don't have the capacity for that."*

Resource constraints play a major role in organisational readiness. Many businesses struggle to allocate sufficient funds, time, and personnel to smart tourism initiatives, especially when faced with the day-to-day pressures of running their own operations. This leads to issues of prioritisation, where immediate operational needs often take precedence over longer-term strategic investments in smart tourism capabilities. Participant #1 comments:

> *I think again it comes back to the size of these companies, they don't have the finances to invest in the systems, they don't have the knowledge, they don't have the manpower…*

This quote illustrates how the small size of companies creates a compounding effect, limiting not only financial resources but also the ability to acquire necessary knowledge and skills. The resource constraints are not just about money, but also about time and attention as participant #1 points out:

> *It's really great if you have the resources to design your own systems or buy the state-of-the-art kind of technology, but when you're a couple running a guesthouse somewhere in the countryside of Iceland, you are worried about "am I going to get money tomorrow to make everything run?" You're worried about where am I going to get the staff? Because [data analytics] is just this is number 755 on your priority list.*

This quote vividly illustrates how day-to-day operational concerns often take precedence over long-term strategic investments in technology and data systems for smaller tourism businesses.

4.4.2.2 Sub theme 2: Skill Deficiency

The lack of data literacy and expertise was identified as a major hurdle in the adoption of data analytics in smart tourism. All participants noted a significant gap in technical skills and data understanding within their organizations. Participant #1 highlighted this issue:

> *Hotel managers are not thinking about [data analytics]. They don't have a data department. They're lucky if they have one person on the team that understands it.*

This issue is potentially problematic for the whole ecosystem as the lack of skills seems to be going from the front-line workers all the way to C level. As Participant #1 continues:

> *I'm doing an MBA and we are actually doing a data analytics course […] these are the future leaders of Icelandic business. We're learning how to do regression analysis and stuff like that. And people are asking, why are we learning this? Why would I learn this? Or why would I understand*

this? I would just go to people that would do this for me or buy the service.

Participant #1 adds further on, commenting on a previous experience in the tourism industry:

I was working with survey data. You do it with a panel because you can't ask everybody in the country what they think. I was explaining this to the C-Suite, and they were like, how do we know that? This is, you know, representative because there's like, it's 95%, you know it's statistically significant, there's a whole theory behind it, you know, but these are C level executives that don't understand these basic things.

This lack of skills is problematic as it hinders the capacity to use existing data. While Participant #1 commented on C-level executives, Participant #2 saw the same issue with her colleagues reasserting the lack of resources found in the chapter above:

I was trying to apply a data-driven approach, however, that relies on most other people in the company also subscribing to that. Which, frankly most people don't because they don't see the value in it. They're also stressed and busy and just need to get things off their desk as quickly as possible

4.4.2.3 Sub theme 3: Strategic Alignment

The Strategic Alignment theme is pivotal in understanding how smart tourism initiatives fit into the broader goals and direction of tourism organisations and the industry as a whole in Iceland. This theme encompasses several interconnected elements: vision, strategy, goals, and leadership, all of which play crucial roles in shaping the approach to smart tourism implementation.

Participant #1 describes this challenge in the following quote, highlighting the need for not just data collection, but also for vision and skills to transform this data into valuable insights:

[Leadership] is collecting data, but they don't know what to do with it. There's no knowledge inside the companies what to do with it, why it's

> *beneficial, and what you can do with it […] the only data that people are used to using here, are visitor data like visitor numbers. Or things, which is more kind of sales and marketing rather than [customer] experience to improve anything. It's more about how much can I sell.*

While all interviews are unanimous in saying that data analytics is a growing demand, Participant #8 mentions the same issue that Participant #1 mentioned, the need to be part of the latest buzzword, yet having no capacities to set it up:

> *[Data analytics] is a recurrent conversation that I'm having with a lot of people right now because everybody and their grandmother is trying to collect data and use data to create value or make decisions. Then, they encounter the difficulty of defining and operationalising what they want to count and understanding the nature of the things that they want to be monitored.*

Participant #2 says:

> *And then in Iceland, honestly, I haven't met anybody within tourism who has really seen the value of [data], even basic things like just collecting room night numbers in order to manage relationship. For me, that's the most basic level of data. Management you can have and even then. I have not met anybody, any manager that seeks the point in that.*

This issue of aligning goals, vision with a competent leadership could be summed up with this quote of Participant #1:

> *Because we are very short-term thinkers here. Long term projects are not sexy here, you know, and in tourism in particular.*

4.4.3 Theme 3: Human Capital and data literacy

This theme encapsulates the knowledge, skills, and attitudes of individuals within the tourism industry that are essential for the successful adoption of data-driven approaches. It comprises several key categories: data literacy, education needs, user skills, and resistance to change.

4.4.3.1 Sub theme 1: Workforce Development

There appears to be a widespread lack of understanding about the value and potential of data in tourism as identified above. This deficit in data literacy hinders the ability of individuals and organisations to effectively leverage data for decision-making and strategic planning. The need for education is closely tied to the data literacy challenge. There's a clear requirement for training and development programs to enhance the data-related skills of those in the tourism industry. This education need extends beyond just technical skills to include broader understanding of how data can be applied to improve tourism operations and experiences. As participant #2 notes:

> *[Salespeople's] job is to take inquiries and sell tours like that's all their concern is so. You need to find a way to make them care about it and make it part of their job. That's something that is exactly the same in every place that I've worked, people just don't do it, It's not their concern. They're not incentivised to care or help you.*

User skills, which relate to the practical abilities of individuals to work with data and data-driven systems, also appear to be lacking in many cases. This could range from basic digital skills to more advanced abilities in data analysis and interpretation. The deficit in user skills can lead to underutilization of available data and technologies.

Participant #7 was also very aware of this issue and acknowledged that it is an urgent one.

> *We pointed out in our draft for tourism strategies, we need education on how to do statistics within this particular field. So, I think that you need to do this on both ends: If you're going to do a more user-friendly dissemination of statistics, you're also going to need to improve users' ability, it goes in hand in hand with each other.*

4.4.3.2 Sub theme 2: Cultural Shift

Cultural influences play a role in shaping attitudes towards smart tourism. The following statement by participant #1 highlights a cultural tendency towards short-term thinking that can hinder investment in long-term smart tourism initiatives. While being only mentioned once, this could be related to the historically volatile nature of

Iceland's economy, which has experienced significant booms and busts, potentially encouraging a focus on immediate gains rather than long-term planning:

> *"Because we are very short-term thinkers here. Long term projects are not sexy, you know, and in tourism in particular."*

Traditional practices in the tourism industry also influence the adoption of smart tourism. Iceland's tourism industry has grown rapidly in recent years, and many businesses may be accustomed to traditional ways of operating that have worked well in the past. This can lead to resistance to new, data-driven approaches that disrupt established practices. The necessity for a data-driven mindset was emphasized by many participants. Four participants noted the need for a cultural change to fully embrace the potential of smart tourism.

The cultural aspect could be resumed as the Icelandic saying “Þetta reddast”, loosely translated as “it will work (*itself)* out”. While 3 participants used expressions such as lack of consciousness or passivity, five have hinted at a herd mentality and lack of interest in forward thinking. Participant #1 states:

> *There will be an idea at some point, and then everyone follows, and that applies to pretty much everything, whether it's like paint that's being used in a hotel or a new activity, and then everybody will copy that activity and go and do it. […] I was at a conference [in 2023]. And [data analytics] was the main thing there. And there's a lot of people were like, oh, this is really smart. This is, you know, I'm like, yeah. This happened five years ago. Like, why are you only hearing about it now? And again, I think it comes back to the size of the companies.*

4.4.4 Theme 4: Implementation obstacles

The Implementation obstacle theme captures the various obstacles and difficulties encountered when attempting to start smart tourism initiatives. This theme is complex, encompassing several categories: general difficulties, access to solutions, collaboration issues, and privacy concerns. These challenges represent the practical

hurdles that organisations face when moving from concept to reality in smart tourism implementation.

4.4.4.1 Sub theme 1: Collaboration Barriers

Collaboration issues form a significant implementation challenge. Smart tourism requires coordination and data sharing between multiple stakeholders, including different private businesses, government agencies, and technology providers. However, establishing effective collaboration can be difficult, particularly in a competitive business environment where organisations may be reluctant to share data or work closely with potential competitors. Difficulties in inter-organisational data sharing emerged as a significant obstacle. All participants noted challenges in collaborating and sharing data across different organizations in the tourism sector. Participant # 1:

> *"I think people are quite protective of their data because it's a highly competitive aspect."*

This quote highlights the tension between the potential benefits of data sharing and competitive concerns.

4.4.4.2 Sub theme 1: Privacy concerns and data protection regulations

While the data did not yield explicit direct quotes, the implications and regulatory complacent were evident in several interviews. The interviews did not produce extensive discussions on regulatory challenges; however, concerns were raised about privacy laws and data protection, suggesting that compliance is likely a factor in the implementation of smart tourism initiatives. The explicit lack of mentions of regulations such as GDPR could indicate a need for greater awareness and education in the industry.

Participant #7 raised a fundamental question about the ethics of data centralisation, this quote captures the tension between the need for compressive data integration and the ethical and legal considerations around privacy and data ownership.:

Do we have a right of being able to act as a single source of truth? What rights do we have? To have knowledge about everything from a single source. Are we OK with simply not knowing something?

4.4.5 Theme 5: Leadership and Strategy

The role of leadership and strategy in driving smart tourism initiatives emerged as a significant theme. Three interviewees expressed frustration with the lack of clear direction from both government and industry leaders.

4.4.5.1 Sub theme 1: Vision and Direction

The lack of a clear direction was universally noted. While DMOs are working in their regions, the Icelandic Tourism Board, which operate under the Ministery of Tourism does not serve as their direct supervisor. This structure leaves each region to its own initiatives and capacities. Participant #7 commented on the need for a more strategic approach which remains a challenge:

[The government's handling of data] there is no overarching strategy. There is nobody who has any overview. Everybody is doing this reactively ad hoc, even if they're doing it in business, they're seeing it because they are chasing something. I think they're dealing with it quite ad hoc and reactively, but there is at the same time, there is a growing understanding that they need to do it more strategically."

The absence of a clear strategy was seen as a major impediment to progress smart tourism initiatives. However, some participants saw signs of improvement, despite this piecemeal approach as discussed in theme 1.

"[University of Science and Innovation], will be making a data strategy for Iceland. I think that was not like what they intended to do when they [government] started out sort of implementing the Open Data Directive, but now at least now they're doing that..."

Vision, in this context, refers to the long-term aspirations for smart tourism in Iceland. It's about imagining what a data-driven, technologically advanced tourism sector could look like and how it could enhance experiences for visitors while benefiting local

communities and businesses. However, the data suggests that such a comprehensive vision for smart tourism may be lacking in many organisations.

4.4.5.2 Sub theme 2: Leadership

Leadership plays a crucial role in driving strategic alignment. Leaders need to champion the vision for smart tourism, allocate resources appropriately, and guide their organizations through the challenges of implementation. However, the data indicates that leadership in this area may be lacking in many Icelandic tourism organizations, particularly in smaller businesses where leaders may be focused on day-to-day operations rather than strategic initiatives.

4.4.5.3 Sub theme 3: Change Management

Challenges in driving organizational change were frequently mentioned by participants. Many noted resistance to new ways of working and difficulties in implementing data-driven processes. Participant #1 observed:

> *"I mean when you have to convince people to use a booking system instead of emails, you know. There is a minority of companies still, they're doing that now but not a long time ago that I was like what I had to do in my job. Like convince people to sign up for a booking system for visitors to book online.*

Change management is another critical aspect of organizational readiness. Implementing smart tourism initiatives often requires significant changes to existing processes, systems, and ways of working. Many organizations, particularly smaller ones, may struggle to effectively manage this change, leading to resistance and implementation challenges.

4.5 FINDINGS DISCUSSION

The above findings align with several key themes in the existing literature on smart tourism and big data analytics. The challenges of data infrastructure and quality echo the findings of Li et al. (2018), who identify these as significant barriers to the effective utilization of big data in tourism. Similarly, the theme of Organizational Readiness

aligns with the work of Ardito et al. (2019), who highlights the importance of organizational factors in successful big data adoption.

The emphasis on Human Capital and Data Literacy in the findings resonates with the work of Mariani and Baggio (2021), who identify a lack of data literacy as a key challenge in the implementation of big data analytics in tourism. The theme of Implementation Obstacles, particularly around data sharing and collaboration, aligns with the work of Gretzel et al. (2015), who stresses the importance of stakeholder collaboration in smart tourism initiatives.

The Leadership and Strategy theme that emerges from the analysis is consistent with the findings of Boes, Buhalis, and Inversini (2015), who emphasize the critical role of governance in smart tourism development. The lack of a clear vision and strategy identified in this study echoes the challenges highlighted by Gretzel (2018) in her discussion of the smart tourism ecosystem.

While the results of the analysis largely align with existing literature, there are some notable contradictions. For instance, while Buhalis and Leung (2018) emphasize the transformative potential of big data analytics in tourism, above findings suggest a more cautious and sometimes sceptical attitude among tourism professionals in Iceland. This may reflect the specific challenges of implementing big data initiatives in a small, geographically isolated market.

Additionally, while much of the literature focuses on technical challenges in big data implementation (e.g., Del Vecchio et al., 2018; Xiang & Fesenmaier, 2017), these findings suggest that organizational and cultural factors may be equally, if not more, significant barriers in the Icelandic context. This highlights the need for a more holistic approach to understanding the challenges of smart tourism implementation, as emphasized by Shafiee et al. (2022).

This study provides several novel insights into the implementation of smart tourism and big data analytics, particularly in the context of a small, geographically isolated market like Iceland. The emphasis on resource constraints and the challenges of scale in a small market provide important nuance to the existing literature, which often focuses on larger, more developed tourism markets.

The core category of Integrated Data Value Management that emerged from the analysis offers a novel framework for understanding the challenges and opportunities of smart tourism implementation. This concept builds on existing literature around value creation in smart tourism (e.g., Buhalis & Leung, 2018) but emphasizes the central role of data in driving this value creation process. This framework can serve as a foundation for future research and practice in the field of smart tourism.

4.6 SUMMARY CHAPTER

The findings of this study reveal a complex landscape of challenges and opportunities for smart tourism implementation in Iceland. Through an analysis of interviews with key stakeholders, five main themes emerged: Data Ecosystem, Organisational Readiness, Human Capital and Data Literacy, Implementation Obstacles, Leadership and Strategy. These themes align with and extend existing literature on smart tourism and big data analytics, while they also offer novel insights into the specific challenges faced by a small, geographically isolated market like Iceland. The core category of Integrated Data Value Management provides a unifying framework for understanding these challenges and opportunities, emphasizing the critical role of data in driving value creation in smart tourism initiatives.

CHAPTER 5 CONCLUSION

5.1 INTRODUCTION

This study reveals a complex landscape for the implementation of smart tourism initiatives in Iceland. Through a qualitative approach involving in-depth interviews with key stakeholders, a complex relationship between factors influencing the adoption and effectiveness of smart tourism initiatives were identified. This chapter presents the key findings and how they address the research objectives mentioned at the beginning of this study.

5.2 CONCLUSIONS

5.2.1 Objective 1 - Assessing theoretical frameworks

The first objective was to assess how existing theoretical frameworks can be adapted or developed to efficiently address the specific needs of implementing smart tourism in Iceland. The findings suggest that current smart tourism frameworks require more than adaptations to account for the specific obstacles found in Iceland. The dimension analysis in table 8 reveals the gap between the theoretical expectations and the practical realities in Iceland. The misalignment is particularly evident in the area of data infrastructure, human capital and leadership.

This study uncovered several challenges not covered by existing frameworks. Firstly, the Icelandic byzantine network of governmental agencies and responsibilities makes it difficult to identify responsibilities for various aspect of smart tourism implementation. This lack of clarity hinders any effective coordination and execution as no single entity is able to get a high level view of the situation and effectively leading any strategy. Secondly, and building on the previous point, the atom-like structures of the Icelandic tourism industry, presents a notable obstacle to concerted efforts in smart tourism development. The fragmented nature of the industry, compounded by the high number of small actors, makes it challenging to reach the required scale and coordination for destination level data-driven initiatives.

As a conclusion, the findings suggest that, at the present, a framework, regardless of its quality or comprehensiveness, is insufficient to ensure a successful implementation in the Icelandic context. The challenges posed by the country's industry structure, limited resource and cultural factors require a more specific and high-level approach that goes beyond theoretical frameworks.

Dimension	Theoretical Expectation	Findings in Icelandic context	Alignment
ICT and Digital Infrastructure	Advanced data systems and analytics capabilities	Lack of sophisticated data systems; manual and inconsistent data collection	Low
Human Capital and Knowledge Management	Skilled workforce capable of leveraging smart tourism technologies	Significant skill gap across all levels; lack of data literacy	Low
Leadership and Innovation Management	Strong leadership driving smart tourism initiatives; clear strategies	Lack of clear direction; fragmented approach; short-term thinking	Low
Sustainability and Accessibility	Focus on sustainable tourism practices enabled by smart technologies	Limited mention in findings; not a primary focus	NA
User Experience and Customization	Enhanced, personalised tourist experiences through smart technologies	Not prominently addressed in findings	Unclear

Table 8 - Dimensions analysis

Based on these findings, it is proposed that any frameworks should place greater emphasis on the resource limitation of smaller markets. A refined framework should include establishing fundamental data infrastructure and competency centres in order to foster collaboration within organisations and overcome the lack of vision of the data value chain.

5.2.2 Objective 2 – key obstacles in the Icelandic smart tourism context

The second research objective was to identify the key obstacles limiting the implementation of big data analytics in the smart tourism sector in Iceland and how they manifest in the Icelandic context. This study found several significant obstacles:

- Immaturity of the data infrastructure
- Resources constraints
- Lack of data literacy and technical skill
- Misalignment between smart tourism initiatives and organisation strategies
- Difficulties in collaboration and data sharing
- Lack of clear leadership and strategy for smart tourism implementation

The findings on the fragmented nature of Iceland's tourism data ecosystem align with the challenges identified in the literature. As noted by Li et al. (2018) and Sigala et al. (2019), the effective use of data presents a large range of opportunities for enhancing tourism services, but also significant challenges. The lack of sophisticated data collection and analysis systems in Iceland's tourism sector, as reported by our interviewees, echoes the concerns raised by Gretzel et al. (2015) and Buhalis and Leung (2018) about the technological and infrastructural challenges in implementing smart tourism initiatives especially about the leading role of government for creating an ecosystem.

The human capital dimension comes out as particularly critical factor in the implementation of smart tourism initiatives. This study uncovered a significant skill gap across the various level of the tourism sector ranging from frontline employee to senior management. As Benoit et al. (2020) observe “People, especially managers, won’t use what they don’t understand” (Benoit, Lessmann and Verbeke, 2020, p. 239). The findings align with previous research by Mariani and Baggio (2021) who identified the lack of data literacy as a key challenge to the implementation of big data analytics in tourism. Similarly, Belias et al. (2021) stressed the importance of knowledge and skills among tourism professionals to effectively leverage data analytics. This skill deficiency not only hinders the adaptation of smart tourism but also hinders the ability to generate valuable insights from the collected data, echoing the concerns raised above by Ardito et al. (2019) regarding the gap between theoretical discussions and its practical implantation in real life situations.

5.2.3 Objective 3 - Actionable strategies and best practices

The third research objective was to identify and recommend actionable strategies and best practices that overcome the identified obstacles. Base on the findings the following strategies and actions are proposed.

- Action 1: Strengthen Collaboration Among Stakeholders

Tackling the obstacles posed by the fragmented and limited resources should be a priority. It is crucial to encourage closer collaboration among the Icelandic Tourist Board, DMOs, and private companies to establish an ecosystem. This cooperation is a recommendation of Gretzel et al. (2018), they stress the importance of public-private partnerships in smart tourism development. Given Iceland's small size, consolidating actors into a unified body entity can facilitate reaching the critical mass necessary for the collaboration and resource consolidation.

To facilitate this collaboration, clearly defined organisational structures must be put in place, defining the roles and responsibilities for each stakeholder. As stressed by Shafiee et al. (2021), the support of government authorities and policy makers is crucial for the development of smart initiatives.

- Action 2: Promote Data-Driven Thinking Among Leadership

The use of data-driven decision, as mentioned in the Icelandic tourism plan, requires promoting a culture of data. It is essential to engage and educate in the tourism industry and other sectors about the value and potential of data analytics, and not just as a buzzword. As highlighted in the literature, it is vital that professionals in this sector understand the importance of data analytics for any implementation to be successful (Del Vecchio *et al.*, 2018; Li *et al.*, 2018; Shafiee *et al.*, 2022). To encourage and promote data-driven thinking and initiatives, a combination of incentives and mandatory requirements should be employed. Businesses and leadership should be required to learn and adopt data analytics best practices ensuring that data necessary for the ecosystem is of quality and accessible by the various stakeholders. This requirement should be balanced with incentives such as data access and industry insights to encourage active involvement by participants. Workshop and industry

conference that showcase successful case studies and best practices should be encouraged.

- Action 3: Establish a Single Source of Truth

The reduction of fragmental data and increase data quality, the creation of a dedicated single source of truth is crucial in Iceland. The literature emphasaise the importance of a centralised data reposositry an effective smart tourism implementation(Sigala, Rahimi and Thelwall, 2019; Shafiee *et al.*, 2022).

As an example, in Spain SEGITTUR, (Sociedad Estatal para la Gestión de la Innovación y las Tecnologías Turísticas) is a state-owned company under the Ministry of Industry, Trade and Tourism responsible for promoting innovation and the application of new technologies in the tourism industry. Playing a key role in the development and implementation of smart tourism initiatives, it created *datasur*, a tourism intelligence system that integrates data from various sources including accommodation, tourist attractions and social media. Inspired by this example, Iceland could create a dedicated data management unit, potentially under the umbrella of the Icelandic Tourist Board with the support of the national statistical office. This unit, specialised in data management, would be responsible for the creation and management of a centralised data repository. The unit would be able to create report and disseminate reports, figures and data to participating stakeholders.

- Action 4: Standardise Data Formats and Protocols

In order to facilitate the distribution and facilitation of data access among stakeholders as mentioned above, the establishment of standardised data format, protocol and definitions is essential. Gretzel et al. (2015) highlights the importance of data standardisation for successful smart tourism initiatives. Discrepancies such as the NATO personal counting anecdote mentioned in chapter 4, exemplify the necessity to standardise and normalise data capture protocols. The many formats and types of data have been highlighted in the literature and without standardised data formats, the creation of models or any other activity will be more complicated.

To facilitate data sharing and interoperability among stakeholders in the Icelandic tourism industry, it is essential to establish standardized data formats and protocols. This echoes the findings of Gretzel et al. (2015), who highlights the importance of data standardization for successful smart tourism initiatives. Issues, like the NATO personal counting discrepancy mentioned in chapter 4, exemplify the necessity to standardise and normalise data capture protocols. The challenges of data heterogeneity have been highlighted in the literature nothing that the lack of standardised data formats can complicate the process of data integration (Del Vecchio *et al.*, 2018; Lyu *et al.*, 2022). Similarly, Xiang and Fesenmaier (2017) stress the importance of data standardisation in tourism, emphasising the need for common data models to facilitate exchange and integration.

The NATO personal discrepancy serves as a practical example of how an issue can occur when data is not standardised nor defined and is captured across many stakeholders and systems. In that case, the aiport management company simply does not have any counting mechanism for this section of the airport. By establishing guidelines and clear definitions for data capture, the Icelandic tourism industry can ensure that data is clean, reliable and suitable for analysis. This effort is closely linked with the creation of a single source of truth proposed in Action 3.

5.3 SUMMARY CONCLUSION

This study explored the many elements of smart tourism in Iceland, discovering the many challenges and opportunities presented in this unique context. The qualitative approach involved in-depth interviews with key stakeholders in the Icelandic tourism industry. It shed a light on a complex ecosystem displaying a deep fragmentation, resource constraint organisations, and a lack of data literacy. At the same time, the situation is marked by an enthusiasm for data and analytics and a growing interest in data-driven approaches. The findings of this study highlight the vital importance of the readiness, in terms of leadership, strategh and skill, of organisations. It also contributed to the theoretical understanding of smart tourism by enhancing the current framework to account for the specific needs of destinations.

From a practical perspective, the study points to several actionable strategies for overcoming the identified obstacles, such as developing a national strategy, investing in a national data platform, and creating a platform for data sharing. Although Iceland faces significant challenges in implementing smart tourism, its small size and close-knit tourism community can potentially embrace a rapid adoption of smart tourism once the initial barriers are overwhelmed. This could position Iceland as a leader in the development and implementation of smart solutions in tourism.

During the last rounds of edition of this study, an article in an Icelandic newspaper Vísir was published, summing up the state of smart tourism initiatives in Iceland. The article highlights the rapid proliferation of parking fees at popular tourist destinations with already thirty sites implementing such charges in the last few years. The Icelandic Tourist Board stresses the need to regulate such trends, naming the current situation to the “wild west” or a state of chaos (Bernharðsdóttir, 2024). The article points out all the lack of clarity in roles and responsibilities in those implementing these fees. This exemple illustrates all the findings of this study, illustrating the fragmented situation, the lack of coordination, the absence of networked solution to fit all stakeholders, visitors and residents alike and reinforce the need for a more strategic and collaborative approach to smart tourism in iceland.

5.4 RECOMMENDATIONS FOR PRACTITIONERS

This study proposes several suggestions for tourism professionals and organisations willing to participate in smart tourism initiatives. Firstly, it is imperative to evaluate genuinely the organisation’s readiness. Elements such as the technological knowledge, the human capital and the leadership’s vision are capital. This evaluation facilitate the identification of areas necessiting investments or improvement prior to the launch of such projects. Furthermore, practitioners should actively pursue networking, collaboration and knowledge exchange opportunities, and not only with the tourism sector. This cooperative approach can assist addressing resource limitations and promote the foundation of data sharing platforms and data standards.

Secondly, tourism organisations should stress the development of data and technological skills among their workforce. This can be realised through training programs, workshops and partnerships with educational institutions. By cultivating a data centric culture and nurturing personal and teams equipped with the necessary skills, organisations can quickly harness data analytics to achieve the aforementioned objectives.

5.5 RECOMMENDATIONS FOR FUTURE RESEARCH

This study has established a foundation understanding the challenges and opportunities associated with the implementation of smart tourism initiatives in Iceland. Future research should aim to address the limitations of this study. A comprehensive quantitative study could validate the generalisation made in this study. Comparative studies with other small markets and maybe tourism dependent, would help understand the extent to which the identified challenges are unique to Iceland. Given the prevalence of micro-enterprises in Iceland, research on their specific challenges and needs in adopting technologies and smart tourism is crucial for the future. Additionally, policy and governance studies could provide valuable insights into the role of government help into establishing strategies.

5.6 LIMITATIONS

While the study provides insight into the challenges and opportunities surrounding smart tourism initiatives in Iceland, it is important to acknowledge several limitations. Firstly, the qualitative approach of this study, while offering rich insights, is limited with its relatively small sample size. While the participants provided valuable perspectives, the limited sample size requires caution when generalising the findings to the broader Icelandic tourism industry.

Secondly, the focus on industry professionals, while providing insider perspectives, may have excluded other viewpoints from key stakeholders. Policymakers, technology providers and tourists themselves were not represented in this sample. This potentially limits the scope of insights, especially regarding policy and governmental implications.

Thirdly, the use of grounded theory, while a robust qualitative method, introduces an element of subjectivity into the process and analysis. The identification and interpretation of themes are inherently influenced by the authors' perspective and potential biases.

Despite these limitations, this study provides a foundational understanding of the smart tourism landscape in Iceland, offering insights that can inform future research and practitioners in this rapidly changing field. The limitations identified also offer opportunities for future research to address these gaps.

APPENDIX

RESEARCH FORM

University of Cumbria http://www.cumbria.ac.uk/

Research Ethics Application for Taught Degree (Bachelors & Masters) students

Application for study including studies that involve Human Participants

NB: Applicants planning research that involves animals should complete a different form

NB: This form should be submitted to your research project module leader once reviewed, discussed and signed by your research supervisor. The form is designed as a discussion document as well as a record of ethical approval. Please ensure you have carried out a Privacy Impact Assessment if your project involves collection of personal data.

All fields will expand as required.

1. Title of Project: **From Saga to Spreadsheet: Iceland's Journey into Smart Tourism**
2. As this a student project, please indicate type of course you are on by ticking/ highlighting the relevant box: □ BSc □ BA **X MSc** □ MA □ MBA □ PgC □ PgD
3. Type of study: please indicate type of study you are on by ticking/ highlighting the relevant box: □ Involves direct involvement by human subjects - (Complete all sections) **X Involves existing documents/anonymised data only - (Ignore sections 7 - 11)** □ Involves fieldwork but no human or animal subjects - (Ignore sections 7 – 11)

4. Name of applicant (the student): Samuel Kohler
5. Your project supervisor(s) Name(s): Micheal Ricco E-mail(s): michael.ricco@rkc.edu

6. Provide a concise **summary of your research project in lay terms** (maximum length 150 words). What are you planning to do? This study examines the integration of smart tourism and big data analytics in Iceland's tourism sector. It aims to adapt existing theoretical frameworks for the unique challenges of smart tourism implementation, identify obstacles in the context of Iceland, and propose actionable strategies. Using an interpretivist philosophy and qualitative methods, approximately 15 key stakeholders will be interviewed, and thematic analysis will be applied to extract insights. The study adheres to ethical guidelines, ensuring informed consent, confidentiality, and secure data management. Despite limitations, including a qualitative approach and a limited sample size, the research aims to contribute valuable insights for advancing smart tourism practices in Iceland and enhancing the efficiency, personalisation, and overall customer experience through big data analytics.
7. Describe the **sample of participants** (including for example, number, age, gender).
8. Explain concisely how you will **recruit the participants** (be specific).
9. Explain concisely how you **obtain informed consent from participants**. You need to ensure it is easy for people to withdraw consent and tell them how.
10. Explain how you will **maintain data protection**. State what personal and/ or sensitive data you may collect and how this will be stored (see guidance UK General Data Protection Regulations (GDPR)).
11. Explain concisely how you will offer **review opportunities**, a debrief or, follow up for participants (as appropriate).

12. Briefly describe each of your **data collection and analysis methods** (you may just have one method)	
Method 1	In-depth Semi-Structured Interviews: The study employs in-depth semi-structured interviews with approximately 15 key stakeholders in Iceland's smart tourism sector. Before the interview, the participant will be provided a Participant Information Sheet. The sheet will inform the participant of his rights to withdraw from the study at any point.
Method 2	Thematic Analysis: Thematic analysis is applied to the interview data. This method involves identifying recurring themes and patterns within the qualitative data.
Method 3	
Method 4	

13. Risks	Explain any risks that your research participants might face because of the research project (this might	Describe how you will control the risks you have identified

	include psychological and reputational risks)	
1	Participants may face the risk of a breach in confidentiality if their responses or identities are disclosed, leading to potential harm or reputational damage.	To mitigate confidentiality risks, all participants will be assigned pseudonyms, and any identifiable information will be securely stored separately. The data will only be accessible to the researcher, ensuring anonymity.
2		
3		

14. Other ethical considerations	
Explain any risks that you may face as a researcher, and what steps you will take to control them.	
Explain briefly any benefits that your research participants may gain from participation. Participants have the opportunity to contribute valuable insights and experiences, aiding in the advancement of knowledge and understanding in the field. Through participation, stakeholders can gain a deeper understanding of the challenges and opportunities in smart tourism and big data analytics, enabling more informed decision-making in their roles.	
Explain briefly how you will collect each type of data– such as hard copy paper / digital / audio / video. The interviews will be audio recorded before being transcribed. The interviewees will be made aware of the recording and consent to be recorded will be asked before continuing. Paper notes will be taken at the same time.	
State a date when you will destroy by shredding, burning or deletion your data files. Note: this should be after the award of a confirmed grade for your degree. 01/02/2026	
15. Check you have considered each issue below and fully explained it in your application, then put x in the box	
I have identified and taken steps to control any physical, emotional or psychological risk to participants	X
I have identified and taken steps to control any cultural offence that might be caused	X
I have identified any vulnerable groups involved and taken steps to control the risks	X
I have explained how I will get permission from managers to recruit participants on their premises	X
I have made clear that no deception is involved in the study	X
I have explained the level of anonymity for participants and how it will be maintained	X
I have explained how participants will be informed and have the chance to ask questions beforehand	X

I have explained how participants may make follow up enquiries after their part in the study	X
I have explained how data will be kept secure and destroyed after the study	X

16. Role	Name	e-Signature	Date
You (Student)	Samuel Kohler		01/02/2024
Your Supervisor	Michael Ricco		

Supportive Materials Checklist

Please attach all necessary supportive materials and indicate in the checklist below.

Supportive Material	Version and Date
Research protocol or research proposal	
Participant Information Sheet	kohler_PIS_01/02/2024.docx
Debriefing Sheet	
Consent Form	kohler_consent_form:01/02/2024.docx
Letter of invitation	
Other (such as interview schedule, questionnaires, measures: please state, and explain)	

PERSONAL INFORMATION SHEET

I would like to invite you to take part in a research study. Before you decide to accept you need to understand why the research is being done and what it would involve for you. Please take time to read the following information carefully. Ask questions if anything you read is not clear or if you would like more information. Take time to decide whether or not to take part.

WHO I AM AND WHAT THIS STUDY IS ABOUT

My name is Samuel Kohler, student in Msc at the university of Cumbria. I am conducting a study on the state of Smart Tourism in Iceland as my final dissertation. The aim of this study is to investigate the integration of smart tourism and big data

analytics within the context of Iceland's tourism sector. The research aims to explore theoretical frameworks, identify practical challenges, and propose actionable strategies for the effective implementation of big data analytics in smart tourism.

WHAT WILL TAKING PART INVOLVE?

Taking part in this study involves participating in an in-depth semi-structured interview. The interview aims to explore your perspectives and experiences related to smart tourism and big data analytics within Iceland's tourism sector. If you agree to participate, we will schedule a convenient time for the in-depth interview. The interview is expected to last approximately 1h15. Questions will cover topics related to smart tourism, big data analytics, challenges faced, and potential strategies for improvement. Your identity will be protected through the use of pseudonyms, and any identifiable information will be securely stored separately. The data collected will be treated with utmost confidentiality.

WHY HAVE YOU BEEN INVITED TO TAKE PART?

You have been invited to take part because your expertise and active involvement in Iceland's smart tourism sector make your insights and experiences particularly valuable for understanding the challenges and opportunities in the integration of big data analytics. As a key stakeholder, your perspectives contribute to a comprehensive exploration of the subject matter. The selection process follows a purposeful sampling strategy, ensuring that participants represent diverse backgrounds, roles, and perspectives within the smart tourism sector. Your inclusion aligns with the aim of capturing a rich and varied range of insights.

WILL TAKING PART BE CONFIDENTIAL?

Participation in this study is treated with the utmost confidentiality. Here are the measures in place to ensure confidentiality:

1. Pseudonyms: Participants will be assigned pseudonyms to protect their identities during the analysis and reporting of findings.

2. Secure Data Storage: Any identifiable information will be securely stored separately from research data. Access to this information will be restricted to the researcher
3. Anonymity of Individuals: The study will avoid disclosing specific details that could lead to the identification of individuals or entities discussed during the interviews.
4. Non-Anonymised Data: Non-anonymised data, such as signed consent forms and audio recordings, will be collected and retained securely as part of the research process. Only the researcher will have access to these materials.

Confidentiality Exceptions:

Confidentiality may be breached in the following exceptional situations:

1. Risk of Harm: If there is a credible and serious risk of harm or danger to the participant or another individual (e.g., physical, emotional or sexual abuse, concerns for child protection, rape, self-harm, suicidal intent, or criminal activity), the researcher may be obligated to report this to relevant authorities for the safety and well-being of those involved.
2. Serious Crime: If the researcher becomes aware of the commission of a serious crime, there may be an ethical or legal obligation to report the incident to appropriate authorities.

These exceptions are implemented to prioritize the safety and well-being of individuals involved. It's important to note that such situations are treated with the utmost sensitivity and handled in accordance with ethical and legal guidelines. Participants are encouraged to discuss any concerns regarding confidentiality during the informed consent process.

HOW WILL INFORMATION YOU PROVIDE BE RECORDED, STORED AND PROTECTED?

The interviews will be recorded for accurate data collection. Here's how the information will be recorded, stored, and protected:

1. Audio Recordings: The interviews will be audio-recorded to ensure precision in data capture.
2. Storage Location: All data, including signed consent forms and audio recordings, will be securely stored in a password protected hard drive.

3. Access Control: Access to the stored data will be limited to the researcher. No unauthorised individuals will have access to the data.

Data Retention Policy:

Signed Consent Forms and Original Audio Recordings: These will be retained securely in password protected folder on a harddrive until after the degree has been conferred.

Transcript of Interviews: A transcript, with all identifying information removed, will be retained for a further two years after the degree has been conferred.

The researcher is committed to responsible data management and adheres to ethical guidelines regarding data retention and participant rights.

WHO SHOULD YOU CONTACT FOR FURTHER INFORMATION?

For further information or clarification regarding this research study, you may contact:

Primary Researcher: Samuel Kohler (0354) 899 5726 samuel.kohler@gmail.com

Supervisor: Micheal Ricco Email

Feel free to reach out if you have any questions or require additional information about the research. Your inquiries will be addressed promptly and comprehensively.

CONSENT FORM

From Saga to Spreadsheet: Iceland's Journey into Smart Tourism

I…… voluntarily agree to participate in this research study.

- I confirm that I have read the information sheet dated [insert date] for the above study, I have had the opportunity to consider the information, ask questions and I have had any questions answered satisfactorily.

- I understand that even if I agree to participate now, I can withdraw at any time or refuse to answer any question without any consequences of any kind.
- I understand that I can withdraw permission to use data from my interview within two weeks after the interview, in which case the material will be deleted.
- I understand that participation involves a recorded in-depth interview of the integration of smart tourism in Iceland, the interview is part of a study for a dissertation at the University of Cumbria.
- I understand that I will not benefit directly from participating in this research.
- I agree to my interview being audio-recorded.
- I understand that all information I provide for this study will be treated confidentially.
- I understand that in any report on the results of this research my identity will remain anonymous. This will be done by changing my name and disguising any details of my interview which may reveal my identity or the identity of people I speak about.
- I understand that disguised extracts from my interview may be quoted in a dissertation.
- I understand that signed consent forms and original audio recordings will be retained on a password protected hard drive only accessible by the author for the next two years. Until [specific relevant period – for students this will be until the exam board confirms the results of their dissertation].
- I understand that a transcript of my interview in which all identifying information has been removed will be retained for two years.

Signature of participant Date

Signature of researcher Date

Signature of researcher Date

INTERVIEW GUIDE

Introduction

Why such a study?

Briefly introduce yourself and the purpose of the interview.

Announce the interview is recorded.

Assure the interviewee of the confidentiality of their responses.

Ask for their consent to proceed with the interview.

Why you?

Questions

General

How would you define the concept of smart tourism, do you know what it is, can you guess?

Tourism supported by integrated efforts at a destination to collect and aggregate/harness data derived from physical infrastructure, social connections, government/organizational sources and human bodies/minds in combination with the use of advanced technologies to transform that data into on-site experiences and business value-propositions with a clear focus on efficiency, sustainability and experience enrichment.

Data maturity

In your experience, to what extent, the development and review of the destination management depends on data?

For you, in your organisation, can you identify what data and indicators are used for developing its strategy (destination/orga).

Physical layer

The physical layer enables the technology layer to execute diverse functions and broaden its application areas. Importantly, what this physically embedded smart technology infrastructure does is feed into the data layer of the smart destination.

Theme - infrastructure

What are the key challenges faced in implementing physical infrastructure for smart tourism, especially in regions like Iceland?

How does the physical infrastructure of a destination contribute to its 'smart' status?

Can you elaborate on the physical infrastructure required for smart tourism initiatives, including natural and human-made resources and transportation infrastructure?

What are the specific physical and technological components of Iceland's tourism infrastructure that can be leveraged for smart tourism development?

Theme - IoT

How does the physical infrastructure of a destination contribute to its ‘smart’ status?

Landscape / Transpiration / Energy grid / Communication

Technology Layer

The physical layer enables the technology layer to execute diverse functions and broaden its application areas. Importantly, what this physically embedded smart technology infrastructure does is feed into the data layer of the smart destination.

Theme - Smartness/tech

What are the key challenges in implementing new technologies in the tourism sector?

How does technology facilitate the integration of the physical, data, business, and experience layers?

How have recent technological advancements influenced the tourism industry?

Can you provide examples of how technology has been used to enhance the tourist experience?

Theme - Front end

Theme - Back end

Theme - Human Capital and skills

How is the IT/data handled in your destination/organisation?

IT dept?

data dept?

external?

Do you have an employee training program about the use of digital technologies and tools / analytics?

In your own terms, is data technology part of your strategy?

is there any framework? is it coming from the bosses?

Data Layer

The data layer allows for the combination of different kinds of data to spur innovation and enable the creation and operation of a digital business ecosystem. Prominent examples that represent the data layer are the tourism observatories many countries and regions are currently establishing (e.g., European Commission 2017).

Theme - data capture

What types of data contribute to (smart) tourism, and how are they collected and utilised?

What are the main sources of tourism-related data available in Iceland, and how can these be effectively utilized for big data analytics in the context of smart tourism?

How do you access data you need?

Can you discuss the significance of big data analytics in extracting insights and intelligence from the data ?

How can destinations ensure data privacy and security while leveraging data for smart tourism initiatives?

Do you use big data? What is it?

do you collect, buy?

What blocks you from using it?

Theme - data storage

What are the challenges associated with collecting, storing, and processing large volumes of tourism data in Iceland, and how can these challenges be addressed?

Do you have a data lake (or a structured database or a repository of all the data you collected) or do you storage the different data sources separately?

Do you internally have a data management office?

Cloud or own server?

Theme - data processing

Do the words modelling, ETL and XX mean anything to you?

What is the main analysis method that you use to extract value from data?

Theme - data analytics

Do you use data analytics and other advanced technologies for data-driven decision making?

What are the key challenges in collecting, analysing, and using data in the tourism sector / your organisation?

What are the main challenges and opportunities associated with implementing big data analytics in your context?

Can you provide examples of how data has been used effectively in the tourism sector / your organisation?

Do you use official (gvt) data to monitor performances?

What would you do differently?

What challenges do you foresee in implementing Big Data Analytics ?

Theme - data sharing

How is data/information/insight disseminated and reported to stakeholders?

Is it reported?

Static/Dashboard/real-time?

Is there a data sharing policy and how would you describe it? Internal vs external?

Theme - data access

How do you feel about sharing certain data with external organisation

What if everybody would do the same?

Have you thought of monetisation of data?

Business Layer

The services and applications created by the business layer using smart tourism data enable touristic experience enhancement and sustainability goals.

Usability

What role do public-private partnerships play in driving innovation and business development in smart tourism?

What are the key factors influencing the success of businesses implementing smart tourism initiatives?

How can Iceland develop or enhance platforms for data sharing and collaboration among stakeholders in the tourism industry to facilitate smart tourism initiatives?

Innovation

How do current tourism services in Iceland utilize data analytics to enhance the visitor experience and drive business innovation?

What are the barriers to the adoption of data-driven service enhancements in the Icelandic tourism sector, and how can these barriers be overcome?

What strategies can be implemented to ensure that data-driven tourism services in Iceland are inclusive, accessible, and beneficial to all visitors?

Provided you would get access to open data, what would do with it?

Openness of data / network

Experience Layer

This experience layer therefore refers to tourist, host, and resident experiences.

Theme - Experience

How do you think Big Data Analytics can enhance the visitor experience at tourist attractions in Iceland? And what are the obstacles?

How do smart tourism initiatives in Iceland translate data insights into tangible improvements in the tourist experience?

What are the key challenges in designing and delivering smart tourist experiences?

How does the experience layer interact with the physical, technology, data, and business layers?

What role do emerging technologies, such as IoT devices and augmented reality, play in enhancing the visitor experience in Iceland's smart tourism initiatives?

What are the ethical considerations when designing smart tourist experiences?

How is data used to enhance the tourist experience?

Is there a feedback loop?

Theme - Governance

How can Iceland enhance its data governance framework to ensure the ethical and responsible use of tourist data for smart tourism purposes?

Do you feel informed of the tourism strategy?

Do you know who is in charge for developing the destination tourism strategy?

Do you collaborate with actors in the smart tourism ecosystem?

Do you have policy measures in place to support the digitalisation of tourism business models, value chains and ecosystems?

Are stakeholders at your destination responsible for creating knowledge and sharing data themselves (Do-it-yourself approach) and in which way?

How can stakeholders in the tourism sector benefit from the use of Big Data Analytics?

How can Iceland measure and evaluate the effectiveness of its smart tourism efforts in terms of enhancing the overall tourist experience and satisfaction?

What role does the DMO play in data management?

Theme - Tourists

How are tourists involved in the development of your destination?

How do smart technologies enhance the tourist experience?

How do the technology- and data-enhanced experiences in the experience layer contribute to visitor satisfaction and destination attractiveness?

CODEBOOK

Code	**Defintion**
Lack of finance	No access to money
Lack of manpower	No access to skilled people
Lack of data litteracy	The staff do not understand data
Lack of tech litteracy	The staff do not understand technology
Resistance to change	The organisation doesn’t want to change
Lack of strategy	The leadership or the management doesn't communicated a clear strategy
Lack of understanding	The leadership does not understand Data Analytics
Lack of vision	The leadership does not have a clear goal or aim or just does it "because"
Lack of knowledge	They do not have the technical know-how
Data collection issue	Data is not collected correctly
Data quality issue	The data shows discrepencies
Privacy Issues	Concerns related to the protection and proper handling of personal information in data collection and usage.
User consent	The process of obtaining permission from individuals to collect and use their personal data.
Legal issues	Challenges or complexities arising from laws and regulations governing data use and management.
Lack of support	nsufficient backing or resources for data-related initiatives from management or stakeholders.

Listening	The practice of actively seeking and considering feedback or input from various stakeholders
Icelandic Culture	Unique cultural context influencing business practices in Iceland.
Privacy Issues	Concerns about protecting personal data and maintaining confidentiality.
User consent	Permission obtained from individuals to collect and use their data.
Legal issues	Challenges related to laws and regulations governing data use.
Lack of support	Insufficient backing for data initiatives from management or stakeholders.
Listening	Active consideration of feedback from various stakeholders.
Icelandic Culture	Unique cultural context influencing business practices in Iceland.
Small company size	Limited scale of operations affecting data capabilities.
Short term thinking	Focus on immediate gains rather than long-term strategies.
Value of data	Perceived worth and potential benefits of data analysis.
Lack of infrastructure	Insufficient technological or organisational structures for data management.
Tourist experience	Overall satisfaction and impressions of visitors.
Customised Service	Tailored offerings meeting individual tourist preferences.
Community Development	Initiatives improving local quality of life through tourism.
Supply chain value	Added benefits throughout the tourism service delivery process.
Data storage	Methods for retaining and organising collected data.
Lack of data maturity	Underdeveloped capabilities in managing and utilising data.

Data silos	Isolated pockets of data not easily shared across an organisation.
Lack of interoperability	Inability of different systems or datasets to work together.
Limited data access	Restricted availability of data due to various barriers.
Data accuracy issues	Problems with the correctness of collected or analysed data.
Estimated data	Information based on approximations rather than exact measurements.
Manual data entry	Time-consuming process of inputting data by hand.
Lack of standardization	Inconsistencies in data formats or collection methods.
Limited data sources	Restricted range of information inputs.
Difficulty in data collection	Challenges in gathering relevant information.
Lack of automated data collection	Absence of systems for automatic data gathering.
Reliance on surveys	Heavy dependence on questionnaires for data gathering.
Unrealized data potential	Missed opportunities to extract value from available data.
Limited use of analytics	Underutilisation of data analysis tools and techniques.
Lack of data-driven insights	Insufficient use of data analysis in decision-making.
Missed opportunities for optimization	Failure to leverage data for improvements.
Personalization potential	Capacity to tailor services based on individual preferences.
Improved tourist experiences	Enhanced visitor satisfaction through data-informed improvements.

Better resource allocation	More efficient distribution of assets based on data insights.
Enhanced destination management	Improved tourism planning using data-informed strategies.
Lack of funding	Insufficient financial resources for data initiatives.
Limited manpower	Shortage of personnel for data-related tasks.
Time constraints	Insufficient time for data collection and analysis.
Lack of technical skills	Deficiency in specialised knowledge for data management.
Limited data understanding	Insufficient comprehension of data concepts and uses.
Need for education	Requirement for training in data-related skills.
Resistance to change	Reluctance to adopt new data-driven practices.
Lack of data strategy	Absence of a comprehensive plan for utilising data.
Lack of perceived value	Failure to recognise the benefits of data-driven approaches.
Prioritization issues	Challenges in determining importance of data initiatives.
Training needs	Areas requiring skill development in data literacy.
Skill gaps	Discrepancies between current abilities and required data skills.
Lack of data awareness	Limited recognition of data's importance in decision-making.
Limited analytical capabilities	Insufficient capacity to interpret data meaningfully.
Resistance to data-driven approaches	Reluctance to base decisions on data analysis.
GDPR compliance	Adherence to EU data protection regulations.
Data privacy issues	Concerns about protecting personal information in data use.
Legal uncertainties	Ambiguities regarding legal implications of data practices.
Regulatory hurdles	Challenges posed by laws governing data usage.
Lack of data sharing	Insufficient exchange of information between entities.

Organizational silos	Isolated departments hindering data flow and collaboration.
Competition concerns	Apprehensions about sharing data with potential competitors.
Trust issues	Lack of confidence in data sharing arrangements.
Limited understanding at leadership level	Insufficient grasp of data concepts among top management.
Absence of long-term planning	Lack of strategic foresight in data initiatives.
Lack of data governance	Absence of formal systems for managing data.
Lack of buy-in	Insufficient commitment to data-driven initiatives from stakeholders.
Cultural barriers	Ingrained attitudes hindering adoption of data-driven approaches.
Communication challenges	Difficulties in conveying the value of data analysis.

THEME AND FREQUENCY TABLE

Theme	Theme %	Category	Category %	Phenomenon	Phenomenon %	Codes exemples
Data Ecosystem	32.50%	Data Infrastructure	11.00%	Immaturity of data systems	5.00%	Lack of data maturity
				Lack of centralized data repositories	4.00%	Data silos
				Fragmented data sources	1.00%	Lack of interoperability
				Limited data sharing capabilities	1.00%	Limited data access
		Data Quality	11.50%	Unreliability of available data	4.50%	Data accuracy issues
				Inconsistency across data sources	3.00%	Estimated data
				Lack of data standardisation	2.00%	Manual data entry
				Prevalence of manual data entry errors	1.00%	Lack of standardization
		Data Collection	10.00%	Prevalence of manual data entry errors	5.00%	Limited data sources
				Limited data validation processes	3.00%	Difficulty in data collection
				Challenges in gathering meaningful data	2.00%	Lack of automated data collection
Organizational Readiness	24.50%	Resource Constraints	10.00%	Limited capacity for data initiatives	3.00%	Lack of funding
				Insufficient funding for data projects	3.00%	Small company size
				Lack of dedicated personnel for data management	2.50%	Limited manpower
				Difficulty in justifying ROI for data investments	1.50%	Time constraints
		Skill Deficiency	7.50%	Lack of data literacy and expertise	2.50%	Lack of technical skills
				Limited analytical capabilities among staff	2.00%	Limited data understanding
				Shortage of data specialists in the tourism sector	1.00%	Need for education
				Gap between technical and domain expertise	2.00%	Resistance to change
		Strategic Alignment	7.00%	Lack of clear data strategy	2.00%	Lack of data strategy
				Short-term focus overshadowing long-term data initiatives	2.00%	Short-term thinking
				Limited understanding of data's strategic value	2.00%	Lack of perceived value
				Resistance to data-driven decision making	1.00%	Prioritization issues
Human Capital and Data Literacy	15.00%	Workforce Development	8.50%	Need for upskilling in data-related areas	2.50%	Training needs
				Limited data training opportunities	1.50%	Skill gaps
				Gap between academic curricula and industry needs	2.50%	Lack of data awareness
				Challenges in continuous learning and adaptation	1.00%	Limited analytical capabilities
				Lack of clear career paths in data roles	1.00%	Resistance to data-driven approaches
		Cultural shift	6.50%	Necessity for a data-driven mindset	2.00%	Need for awareness
				Resistance to data-driven decision making	2.50%	Personalization potential
				Limited data sharing culture	1.00%	Better resource allocation
				Lack of leadership support for data initiatives	1.00%	Enhanced destination management
Implementation Obstacles	12.50%	erns and data protection	6.50%	Legal and privacy concerns impacting data use	2.00%	GDPR compliance
				Complexity of data protection regulations	2.00%	Data privacy issues
				Uncertainty about legal implications of data use	1.50%	Legal uncertainties
				Challenges in obtaining user consent for data collection	1.00%	Regulatory hurdles
		Collaboration Barriers	6.00%	Balancing data use with privacy protection	2.00%	Lack of data sharing
				Difficulties in inter-organizational data sharing	1.00%	Organizational silos
				Competitive concerns limiting collaboration	1.50%	Competition concerns
				Trust issues in data sharing partnerships	1.50%	Trust issues
Leadership and Strategy	15.50%	Vision and Direction	7.50%	Need for clear data leadership	2.00%	Lack of data strategy
				Lack of long-term data strategy	1.00%	Limited understanding at leadership level
				Limited understanding of data potential among leaders	2.00%	Absence of long-term planning
				Absence of data governance frameworks	1.50%	Lack of data governance
				Misalignment between organisational and data strategies	1.00%	Resistance to change
		Change Management	8.00%	Challenges in driving organizational change	2.00%	Lack of buy-in
				Resistance to new data-driven processes	1.00%	Cultural barriers
				Difficulty in communicating the value of data initiatives	1.00%	Communication challenges
				Lack of change management strategies for data projects	1.00%	
				Cultural barriers to data-driven transformation	3.00%	

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