



Measuring and managing sustainability impacts of tourism from a subnational perspective

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Doctor of Economic, Social and Political Sciences

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Born on 21st January 1982 in Gera

Submitted on: 22.09.2023

Thesis defense on: 15.01.2024

First supervisor and reviewer: Prof. Dr. David J. Abson

Second reviewer: Prof. Dr. Henrik von Wehrden

Third reviewer: Prof. Dr. Wolfgang Strasdas

The individual items in the cumulative thesis are published as follows:

Balas, M., Abson, D. (2022). Characterising and identifying gaps in sustainability assessments of tourism - a review. *Tourism Management Perspectives*. 43, 101004
<https://doi.org/10.1016/j.tmp.2022.101004>

Gössling, S., Balas, M., Mayer, M., Sun, Y.-Y. (2023). A review of tourism and climate change mitigation: The scales, scopes, stakeholders and strategies of carbon management. *Tourism Management*. 95, 104681 <https://doi.org/10.1016/j.tourman.2022.104681>

Balas, M., Mayer, M. The challenge of climate change and net zero emissions for destinations. In Pillmayer, M., Hansen, M., Karl, M. *Tourism destination development: A geographic perspective on destination management and tourist demand*. De Gruyter Tourism Studies

Balas, M., Dmytrów, K., Mayer, M., Zbaraszewski, W. (2022). Economic impact analysis of tourism in protected areas of the Pomerania region. In: Zbaraszewski, W., Balas, M., Dmytrów, K., Majewska, A., Mayer, M., Steingrube, W. (2022). *Socio-economic research in protected areas of the Euroregion Pomerania: Visitor satisfaction, economic impacts and park–people relationships*. Poznań: Bogucki Wydawnictwo Naukowe.

Mayer, M., Balas, M., Dmytrów, K., Zbaraszewski, W. (2022). Analysis of park–people relationships. In: Zbaraszewski, W., Balas, M., Dmytrów, K., Majewska, A., Mayer, M., Steingrube, W. (2022). *Socio-economic research in protected areas of the Euroregion Pomerania: Visitor satisfaction, economic impacts and park–people relationships*. Poznań: Bogucki Wydawnictwo Naukowe.

Year of publication: 2024

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*Dedicated to
my Fantastic Four
& my Superwoman.*

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Preface

This dissertation is presented as a series of manuscripts. The chapters additional to this framework paper (Chapter I) are designed to be stand-alone articles and book chapters intended for scientific publication. Due to formal requirements, stylistic differences (e.g., differences in formatting requirements) are possible among the articles. All chapters and appendices, except Chapter IV, have been published and the content has not been changed. Chapter IV has been submitted as a book chapter to an international publisher (DeGruyter Publishing) and is therefore formatted in a similar style to the framework paper. References to each corresponding journal and the contributing co-authors are presented on the title page of each chapter or in the Appendix. The style used for citing literature in the text and for the references sections at the end of each chapter and appendix respects the formatting requirements of the corresponding journal and publisher where the respective manuscript was published or submitted to. Chapter I uses the APA reference formatting style.

Abstract

The emergence of sustainability as a guiding principle for tourism development came along with needs to introduce instruments that can monitor the actual impacts of tourism. Sustainability assessments in tourism (SAT) have gained popularity in recent years with a range of measurement schemes being introduced for national and subnational tourism destinations. With the help of sustainability indicators these schemes intend to guide decision-makers in making better evidence-informed decisions and to improve the overall sustainability performance of tourism. Yet, sustainability assessments have hardly led to changes in organisational or management structures in tourism in the last years.

With this dissertation I aim to contribute to a deeper understanding of the implementation and performance of sustainability assessments, by linking transformative needs of tourism with necessary assessment approaches that can serve as effective instruments for a shift towards a more sustainable tourism development. Thus, the research is part of recent efforts to establish profound and effective measurement approaches for sustainable tourism.

I employ a mixed-methods approach combining qualitative, quantitative, set-theoretic, and review methods, with the aim of maximising the validity of results. First, I explore the general progress and current state of research on sustainability assessments in tourism, with the intention to identify patterns, key elements and research gaps within assessment approaches. This is followed by subsequent detailed analyses that examine specific environmental and socio-economic sustainability issues with the aim of providing conceptual, methodological and empirical solutions for assessing them in detail.

My dissertation highlights that concrete assessment tools are needed for evidence-informed decision-making and the establishment of effective actions in destination management. The findings indicate that assessments will be more successful in terms of serving as tools for decision-making, if they tackle main drivers of change and encourage management or policymakers to take decisions that affect multiple sustainability issues. It also reviews different concepts and accounting principles and raises awareness of a cautious selection of methods and measurement approaches, as this may affect overall results. The thesis empirically evaluates and applies different measurement approaches in specific destinations, with the help of quantitative and qualitative data collection methodologies. In general, my thesis provides further clarification about key environmental and socio-economic measurement methodologies, which supports ongoing debates about sustainability impacts of tourism. Thus, the research contributes to knowledge, frameworks, methodologies and practical application for tourism governance and tourism sustainability science.

Keywords: sustainable tourism assessments, indicators, tourism impacts, sustainability transformation

Chapter I

Measuring and managing sustainability impacts
of tourism from a subnational perspective

1. Introduction

Human activities nowadays shape environmental and societal developments across the globe. How social and natural systems evolve and remain in a balanced state has been part of scientific debates for many years (Ellis et al., 2018; Crutzen, 2006; Waters et al., 2016). Incidences such as the Covid-19 pandemic reveal the tightly coupled relationship between nature and people worldwide, creating strong forces on politics, communities, the economy and humanity's attitudes towards natural systems in general (Hall, Scott & Gössling, 2020).

In a broader sense, system dynamics that are conveyed through 'disturbances' such as pandemics can influence several temporal and spatial scales: "What happens at one scale, can influence or even drive what's happening at other scales" (Walker & Salt, 2006). Cross-scale interactions are common in complex systems and describe the interdependence between different levels of a system (Cash et al., 2006). As long as transfers from one level to another are maintained, it is possible to alter interactions within the levels themselves, without the system losing its integrity or failing.

Tourism can be perceived as a complex system that continuously withstands external influences on different levels and is embedded in a wider socio-economic and social-ecological environment (Espiner, Orchiston & Higham, 2017). It is one of the world's major economic sectors, being the third-largest export category, contributing around 7% of global trade and being a supporter of one in 10 jobs worldwide (UNWTO, 2022). The capability of adaptation, learning and innovative thinking has been a main subject of modern tourism management in the last few decades (Fabry & Zeghni, 2019), with sustainability being a concept for the proactive management and planning of destinations, in order to increase the persistence and adaptability of tourism stakeholders in times of external disturbances (Bramwell et al., 2017).

When considering tourism as an economic activity, the need to adopt a sustainable approach is aggravated by its multi-sectoral nature and its dependence on social-ecological systems, in terms of intact destination environments and communities (White et al., 2006). It may be put in a way that "tourism, which degrades any elements of host communities, threatens its own future" (Manning, 1999). Hardin's (1968) 'Tragedy of the Commons' concept is inherent in tourism, as tourists tend to be attracted to the more vulnerable and sensitive areas, which in turn creates a strong management responsibility that lies with many different stakeholders.

There is a growing awareness that tourism destinations need novel strategies to cope with long-term future challenges (Luthe & Wyss, 2014). This awareness has increased rapidly in the last few years, and calls for a more sustainable and resilient form of tourism have become omnipresent in both the literature (Prayag, 2020) and the industry itself (UNWTO, 2021).

Globally, tourism is the only economic sector explicitly anchored in three targets of the Sustainable Development Goals (UNWTO, 2017b). The primary focus falls on target 12b, which emphasises sustainable consumption and production patterns in tourism and the continuous monitoring of sustainable associated practices (UNWTO & UNDP, 2017). Due to the spatial characteristics of tourism activities (Bieger & Beritelli, 2013), many tourism-related sustainability aspects are mainly relevant within sub-national contexts (UNWTO, 2017b; INRouTe, 2017). A range of ecological as well as socio-cultural tourism impacts are a result of the temporal and spatial activities of tourists (e.g., overcrowding).

The need to assess the environmental and socio-cultural impacts of tourism at the global, national and regional level is regularly highlighted in publications (Rasoolimanesh et al., 2020; Epler Wood et al., 2019; Torres-Delgado & Palomeque, 2014), and overall, there is a general agreement about the lack of integration of sustainability indicators into actual tourism policy and planning (Asmelash & Kumar, 2019; Vila, Costa & Rovira, 2010). At present, data about tourism impacts on the required regional spatial and temporal scales barely exist or require very complex data collection methods, especially if they are supposed to be connected to national tourism development objectives (Batista e Silva et al., 2018).

Current necessities to develop transformative strategies in tourism, in combination with the actual challenge of quantitatively assessing major tourism impacts, create a certain orientation gap in terms of defining key elements that are able to generate changes in the tourism model without destabilising the overall system. Recent publications indicate that new tourism models will at least need to provide solutions for low-carbon tourism development while maintaining local incomes and employment benefits and assuring positive community sentiments towards tourism (Gössling & Higham, 2021; Scott, Hall, & Gössling 2019; Sharpley & Telfer, 2015; Schilcher, 2007).

This dissertation aims to link transformative needs of tourism with necessary approaches that assess elements of sustainable tourism development on the subnational level, with a special focus on protected areas, the most prevalent of which are the most attractive and the most vulnerable destinations. The thesis was partly developed as part of two larger research projects: (1) "REGE – Cross-border cooperation between universities and large-scale protected areas in the Pomerania Euroregion" and (2) "Enhancement of sustainable tourism: Determining the share of sustainable tourism in value generation in Germany and strengthening cooperation with and between important stakeholders".

The first project aimed at working out common methodologies for collecting, analysing and evaluating data on the social and economic impacts of large-scale protected areas. The goal of the second project was to develop a practical system for measuring the sustainability of national tourism in Germany. My thesis is integrated into sections of both projects and concentrates on advancing the measurement of tourism impacts in the fields of climate mitigation, socio-economic valuation and local perceptions of tourism development. The central focus of this thesis is to support project findings by capturing essential elements of tourism transformation with scientific sound conceptual approaches, and showcasing sustainable pathways for the future development of subnational tourism.

Moreover, this thesis aims to further explore theoretical work on climate change management in tourism, as it is the most demanding current challenge for the industry. Here, I emphasise on climate accounting, but also examine future development projections in terms of climate mitigation and adaptation, including related implications for future tourism development. In this scientific endeavour, I am motivated by the desire to comprehend the specific spectrum of the climate crisis in tourism as an ideal example of transformative change.

The overall personal motivation of this thesis is to provide solutions for tourism researchers and regional destination managers, in order to help them cope with transformative challenges, supported by evidence-based information allowing for the application of sustainable economic practices. Hence, this thesis is an attempt to bridge the gap between practical approaches to and the scientific demands of sustainability developments in tourism.

The main aim of this dissertation is to enhance ongoing debates about sustainability measurements in tourism, by exploring assessment implications of different scales and by focusing on the environmental and socio-economic impacts of subnational tourism.

Specifically, the thesis investigates the subject from different scales of abstraction and with a mix of methods and concepts (see Fig. 1), focusing on the following five major research topics.

First, I explore the general progress and current state of research on sustainability assessments in tourism, with the intention to identify patterns and research gaps within assessment approaches (*Chapter II*, Review paper).

Second, I specifically address the evolution of climate change mitigation in tourism, by providing a conceptual framework for mitigation dimensions, including a particular emphasis on emission inventory comprehensiveness, emission allocation principles on different scales, clearly defined responsibilities for decarbonisation and the identification of significant mitigation strategies (*Chapter III*, Review and Conceptual paper).

Third, this leads to a more detailed discussion about carbon and climate risks that arise from the need for transformative changes in terms of climate mitigation and adaptation strategies for subnational tourism destinations (*Chapter IV*, Conceptual paper).

Fourth, I explore the need for robust economic impact analyses of tourism as a source of local economic value creation, by providing a particular example of implementing methodological approaches for economic impact assessments in two protected areas of the Pomerania region (*Chapter V*, Empirical paper).

Lastly, I intend to elaborate on general local interactions within regional contexts that lead to specific community sentiments towards (tourism) development, by implementing an empirical analysis of park-people relationships in fourteen protected areas in the Pomerania region, based on an explanatory framework representing the attitudes and behaviour of local people in relation to protected areas (*Chapter VI*, Empirical paper).

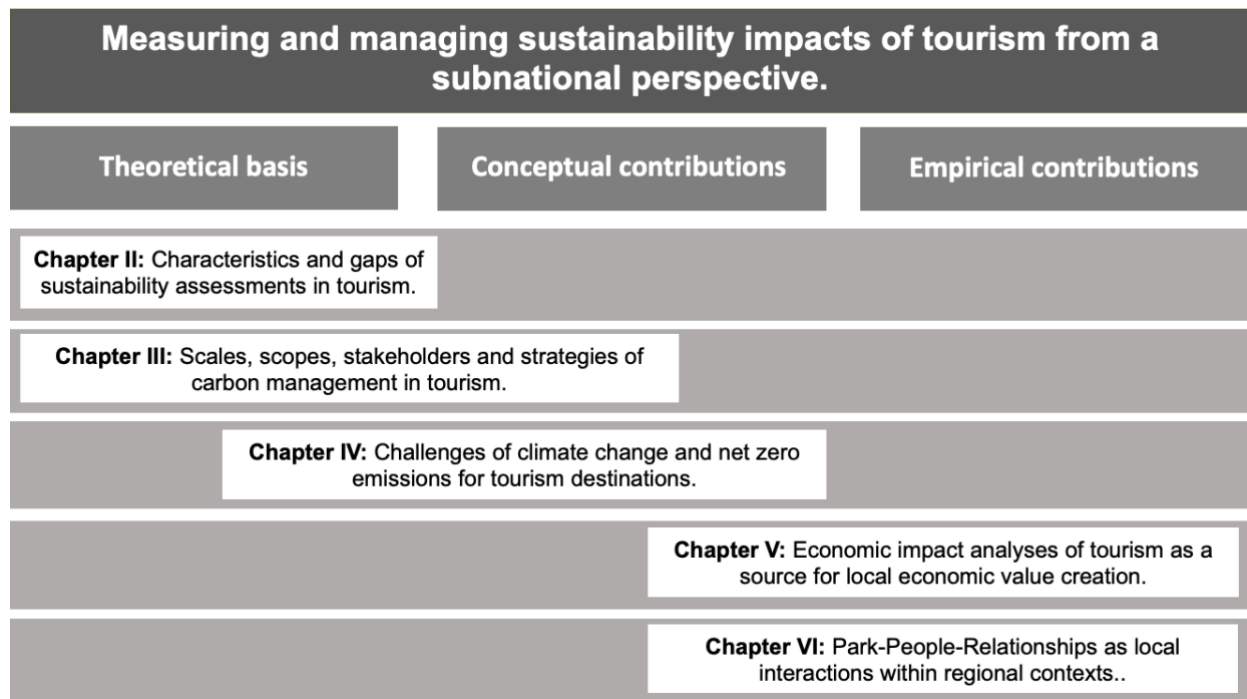


Figure 1: Relationship between papers and their contribution to the thesis' objectives.

This chapter summarises the introduced research topics, and the next section underpins the further conceptual and theoretical background for this dissertation, followed by the methods implemented herein. The third section summarises the main results and limitations of the research, by introducing the five main publications as well as six further supplementary publications that relate to the subject. Subsequently, I reflect on how the insights from this thesis contribute to the literature and to the practical application of sustainable tourism development.

2. Conceptual and methodological background

This thesis is largely linked to theories of interaction between human activities and the environment that acknowledge the creation of knowledge as the interplay between different concepts and which are relative to each experience. Thus, the theoretical approach of this thesis is based on a multi-paradigmatic philosophy of disciplines as an interface between social, economic and natural sciences. This mainly involves the situational application of both qualitative-constructivist research approaches and quantitative hypothesis-based analytical procedures. All presented papers include application-oriented research related to sustainability economics, with a specific focus on issues of transition, systems understanding and resilience management, as well as global environmental and resource economics.

2.1 Transition as an orientation towards the long-term future

The work presented herein relates to the idea that the global environment is constantly changing, with different scales across time and space but with certain connections through global physical and social processes (Hall, 2010; Meyer & Turner, 1995). Often described as

transition and/or transformation, global change involves interconnections that reinforce each other but take place in different contexts, such as technology, the economy, institutions, societal structures and individual behaviour (Rotmans, Van Asselt & Kemp, 2001). The setting of multiple causalities and co-evolution between independent developments relates to the general concept of human-environmental systems (Forbes et al., 2009; Berkes et al., 2003; Gunderson & Holling, 2002) and emphasises the relationships and interactions between social and natural components, which plays a critical role in sustainability economics (Baumgärtner & Quaas, 2009). In this setting, the thesis refers to modern sociotechnical structures as the main drivers of human development (Geels et al., 2017). Such structures are an efficient mix of technologies, infrastructures, productive units, regulations and individual practices that deliver societal functions, as in the case here, namely tourism as mainly being an activity of personal mobility. Sociotechnical structures have been well established throughout consumptive processes and serve as widely accepted instruments for economies. Nevertheless, they also come with destructive processes (Boivin et al., 2016), specifically long-term changes to the physical environment that can be harmful to species (Laland et al., 2014), and issues of social justice in terms of socioeconomic and cultural dependencies (Jonas, 2016). The original sustainable development concept aims to reduce these impacts while maintaining long-term economic productivity (Hopwood, Mellor, O'Brien, 2005) and therefore inherits the demand for transition and global change towards a desirable future for humankind (WCED, 1987). The main notions of sustainability have been recognised for decades in international policymaking (Jonas, 2016; Hall, 2011), with many firms, individuals and governments claiming to develop and implement sustainable practices. However, criticism about missing outcomes and achievements has increased steadily (Sterman, 2012; Rees, 2012), with a main emphasis on rebound effects, trade-offs and general boundaries due to system complexities (Rees, 1992; Weinstein, 2013). A growing number of authors have therefore pledged for a stronger integration of systems thinking in sustainability concepts, with the aim of broadening perspectives and creating a new knowledge base that engages actions on multiple scales and over successive generations (Sterman, 2012; Westley et al., 2011).

2.2 Systems understanding and resilience management

The second research philosophy I stress in my research is the identification of specific system-level parameters that act as potential drivers for change. It is a typical notion of sustainability to create, test and maintain adaptive capabilities and opportunities for the future (Holling et al., 2002). By understanding complex systems such as tourism, i.e., as a combination of elements nested in a hierarchy across time and space, it is possible to generate combinations of system elements (e.g., innovations or experimental measures) that can be tested over longer periods without automatically triggering cascading instabilities of the whole, due to the stabilising nature of the overall nested hierarchies. This potential is highlighted in the transformative resilience concept, which places emphasis on identifying patterns that eliminate traditional path dependencies and create newly defined stabilities (Berkes et al., 2003). Central elements for new paths in tourism (and other economic activities) are the establishment of regional economies towards a steady-state equilibrium, in line with planetary boundaries, and strengthening individual and local structures of self-determination (Gössling & Higham, 2020; Espiner et al., 2017; Hall,

2009 & 2011). However, as straightforward as this might sound, actual application is just as challenging. Tourism policy, tourism studies and assessment frameworks still perceive the notion of sustainability mostly as being 'environmental', and the idea of development is often seen as 'economic' and to a certain extent 'social', with the concept of sustainable development aiming to bring about reconciliation between ecological (sustainability) interests and economic (development) paths (Scott, Hall & Gössling, 2019; Hall, 2010; Sachs, 1993). This rather isolative perception interferes with the idea of systems thinking and transformative resilience. Therefore, my research elaborates on quantifiable parameters in tourism for potential new paths that trigger dynamic tourism development processes and help establish an enhanced understanding of destination management as a strength-based approach in dealing with crises and change. In this sense, such variables intend to build a bridge between systemic and normative approaches to sustainable tourism development.

2.3 Environmental economics in tourism

Tourism as an economic activity is associated with environmental impacts on a global scale, and increasingly as a relevant factor for global resource depletion (Lenzen et al., 2018; Lew, 2009; Hall, 2005, 2008, 2010; Gössling, 2002). Thus, as this dissertation's research deals with tourism impacts, it inherently also touches upon the discipline of environmental economics, with an emphasis on natural resource allocation. Resource depletion and pollution has been a focal point of environmental economics since the 1960s (Beder, 2011), especially in relation to the integration of environmental values into cost-benefit analyses and internalising the costs of environmental and ecological degradation into price calculations (Hanley, Shogren & White, 2019). As tourism is an economic activity that involves people travelling to national or international destinations, along with expenditures in different locations and services produced domestically and internationally, the allocation of environmental impacts is challenging on scales below the global. The geographical phenomenon of tourism as a cross-sectoral economic activity that occurs across time and space, creates economic and environmental effects that are produced at every stage of a journey, with the environmental impacts often not being correctly allocated (Hall, 2005). Several analyses of tourism and environmental effects demonstrate that by only focusing on what occurs at a specific site, rather than over an entire trip, will likely lead to a substantial underestimation of the overall environmental impacts of tourism activities (Hall, 2010). Therefore, parts of this thesis deal with the issue of allocating environmental impacts, using an environmental economics allocation perspective.

2.4 Methodological approach

Any investigation of sustainability impacts for tourism as a complex system requires an interdisciplinary approach that can tackle economic, social and environmental disciplines. Therefore, I employed a wide range of conceptual, methodological and empirical approaches to help capture the specific aim of my thesis. In general, it involved desk research and, both, qualitative as well as quantitative methods for data collection and analysis, along with an attempt to maintain some form of balance between them (see Fig. 1). For the empirical papers, I contributed to data collection through several types of questionnaires and surveys. These were

accompanied by more than 14,000 structured interviews in 15 regions, using different types of distribution channels such as personal, telephone and online interviews, depending on the type of questionnaire, the required sample size and the target group. In addition, we used secondary data sources to conduct regional economic impact analyses by means of an input-output model, applied to tourism in a protected area. As qualitative methods, I mainly conducted thematic analyses (Chapters II, III and IV) and operationalised predefined variables through coding for further analyses. Quantitative methods included a range of descriptive statistics (all chapters), multivariate methods such as a hierarchical cluster analysis (Chapter II) and chi-square, p-value and Cramer's V tests (Chapter VI). All methods were applied in an explorative manner or by using predefined conceptual approaches, so that they would fit into the overall analysis.

The following section specifies in further detail the methods used for each paper, as the approaches vary substantially and need to be put into the corresponding context of the paper.

3. Research paper summary

This section provides an overview of the five papers making up the main body of this thesis and six further publications that expand on the overarching aim of the dissertation (see Appendix I-VI for a full list and summaries of these publications). For each main paper I provide a review of the envisaged research objectives, explain the specific methodological approaches and present key results. Further, I summarise the main limitations and possible further conclusions of each research. The publications in the appendix will be shortly summarised to provide further background knowledge and additional substantiation of the thesis. This will then lead to a general synthesis in section 4.

3.1 Paper 1: Characterising and identifying gaps in sustainability assessments of tourism – a review

In the paper *Characterising and identifying gaps in sustainability assessments of tourism – a review*, we aimed to examine the main development stages, general progress and the current state of research on sustainability assessments in tourism (SAT). We identified and characterised a range of different approaches used to assess sustainability in tourism, examined similarities and differences between these approaches by presenting different types of assessments and critically discussed the findings in relation to research on SAT, with a particular focus on suggesting improvements for each of the introduced assessment stages.

For the analysis, I performed a systematic semi-quantitative literature review of 81 peer-reviewed publications conducting empirical research on SAT. The review was based on an extensive search string, followed by title and abstract screening, as well as eligibility screening, to condense the relevant literature. The review process was guided by an evaluation scheme of variables covering all of the main stages in developing SAT, which helped to code the variables into multinomial and binary categories for the analysis. At first, a main descriptive analysis was applied, followed by an agglomerative hierarchical cluster analysis, to identify groups of publications that applied similar overall assessment approaches and to provide clear distinctions with other types of assessments.

We identified five SAT clusters: (1) new frameworks that develop indicator sets and assessment methodologies, (2) case studies that apply existing indicator sets or frameworks to specific areas, (3) system-based approaches that contextualise existing indicator work on sustainability in tourism and develop new perspectives and (4) indices assessments that compare destination sustainability through the use of composite indicators.

In general, our review revealed a wide range of assessment approaches, not only portraying ongoing academic reflection on the constantly evolving character of sustainability concepts (Pulido-Fernandez, Sanchez-Rivero, & Lopez-Sanchez, 2011), but also creating an environment of increased complexity, due to seemingly endless choices for sustainability assessments. In addition, most of the empirical work was carried out as one-time assessments, thereby negating the necessity to continuously monitor sustainability impacts. The divide between theoretical demands on assessments and actual practical applications was also confirmed through our analysis, as we determined that only a minority of assessments included tourism stakeholder involvement. Our results regarding the measurability of tourism-specific sustainability issues coincide with the findings of Font et al. (2021), who stress the general point that sustainability indicators in tourism are still mostly used as a diagnostic tool for DMOs but hardly lead to actual changes in organisational or management structures. Accordingly, if indicators could indeed enable evidence-based decisions, the collected data would need to directly present tourism-specific areas of concern and also be clearly related thereto. A main deficiency that we identified, was the missing connection between indicators and sustainability targets, which has also been stated in other studies (Blancas, et al., 2011). In relation to the identified assessment clusters, we confirmed that all of them are confronted with similar challenges regarding the process involved in indicator development and measurability. Our analysis suggests that more research is needed on how existing frameworks and assessment approaches could be better contextualised, so that the vast amount of already generated data can be better put into different contexts and be used for target-oriented decision-making.

The structured and systematic approach we pursue in this paper comes with a few limitations. First, we focused solely on empirical and peer-reviewed work on sustainability assessments, thereby potentially excluding a range of studies that were undertaken in applied contexts or by institutional efforts. Thus, missing the contextualisation of assessments and a lack of stakeholder integration might be tackled in frameworks with a stronger practical focus. Indeed, recent publications by Crabolu (2021) and Crabolu, Font & Miller (2023) point out that well-organised participatory processes included in developing assessment frameworks lead to stakeholder buy-ins, active engagement and even to direct policy change. However, they also highlight the need to 'translate' and to facilitate the complexity of indicator development processes. Another limitation is certainly the difficulty involved in grasping all of the existing concepts and assessment approaches. Within the 81 analysed papers, we identified 28 different theoretical concepts that were used to set up sustainability indicators. This heterogeneity of approaches would need a deeper understanding to analyse their suitability for sustainability assessments, which was not possible within this paper. Finally, the identification of assessment clusters was based on a limited number of variables that not only showcased important differences in their approaches to sustainability assessments, but also only provided a limited depth of informative value. Thus, it

would be helpful to apply these clusters to other studies and reviews – and thus to improve the overall eligibility of these approaches.

3.2 Paper 2: A review of tourism and climate change mitigation: The scales, scopes, stakeholders and strategies of carbon management

The paper *A review of tourism and climate change mitigation: The scales, scopes, stakeholders and strategies of carbon management* picks up on an outcome from the first paper, namely the need for sustainability assessments to provide tourism-specific, reliable and continuous data that fit to the user's needs and are based on internationally recognised standards. This demand is applied to the case of carbon management in tourism, i.e., one of the most pressing challenges of the sector (Gössling, 2011) and a main leverage parameter for the overall transition of destination management models (Gössling & Higham, 2020). Thus, the paper does not solely deal with carbon accounting but rather explores general interrelated and interdependent dimensions for effective carbon management in tourism. Based on literature about climate change mitigation, we introduce the S4C model of carbon management in tourism, which considers four key elements of decarbonisation: scale, scope, stakeholder and strategy. We elaborate on emission inventory comprehensiveness, allocation principles on different scales, clearly defined responsibilities for decarbonisation and the identification of significant mitigation strategies to implement effective carbon management. Based on the S4C model, we develop mitigation trajectories for specific tourism segments and provide recommendations to advance net-zero goals.

Methodologically, we conducted a thematic and systematic literature review that aimed to advance the state-of-the-art understanding of the different dimensions of carbon management. We separated the review into two parts: For the dimensions scope and scale, we performed a semi-quantitative review, whereas we did a qualitative evaluation for the stakeholder and strategy dimensions. This approach was chosen as a learning point from the first paper, in order to gain more in-depth information on specific aspects of the topic. As a considerable number of papers have already dealt with the complexities of the scopes and scales of carbon management in tourism, we favoured a more structured review. We chose a similar approach as presented for Paper 1, using an evaluation scheme to analyse a total of 62 scientific papers. The qualitative analysis focused on an account of developments about the topic over the past 25 years and included grey literature such as studies by the industry itself. The evaluation mainly followed an expert-based approach, to better contextualise existing complexities and objectives of individual reports.

The paper contains a rich variety of findings. First, we identified that greenhouse gas (GHG) emissions from tourism are analysed on all levels on which mitigation can be implemented and monitored, i.e., global-, national-, destination (sub-national)- or business-level. A wide range of assessment approaches mostly follow the purpose of investigation, such as understanding tourism relevant GHG emissions on a geographical scale as an economic system, as a combination of specific subsectors (accommodation etc.) or as specific tourism products. Measurements on the business level represent the most common approach and often follow internationally established frameworks and standards (UNWTO, 2023; Becken & Bobes, 2016).

Our findings verify that GHG accounting enables destinations to map and evaluate different development paths for the required extent of GHG reductions. There are four elements to the scope dimension: the subsectors to be included, such as accommodation, transport or shopping; the visitor segments to be considered, such as domestic, inbound and outbound tourism; the extent of the supply chain being evaluated (direct and indirect emissions at the destination level) and the type of emissions included, namely CO₂, other long-lived GHGs and non-CO₂ warming from air transport. Ultimately, allocation principles and data availability guide the decision to include certain components.

The analysis highlights that GHG emissions arise from a range of different tourism service providers at a destination. Calculations can be based on either visitor volumes and activities connected with information on specific tourism sub-sectors (bottom-up) or (larger-scale) destinations calculating emissions using environmental accounting methods that identify emissions along the chains of production and distribution (top-down).

Our findings reveal that information about tourism specific emissions is specifically relevant for destination management. As a baseline, it enables the setup of tailor-made GHG reduction targets and implementation strategies for different segments within the destination, which allows for an evidence-based climate management approach. Later, tourism-related carbon accounting will help monitoring progress and failure to adjust GHG management. It also enables comparisons with both national tourism emissions and other economic sectors. Furthermore, emission intensities can be mapped, i.e., setting emissions in relation to value added, which is of importance for regional/national climate action plans and green growth strategies.

In addition to accounting levels and elements of emission measurements, it is also important to assign responsibilities for carbon management (stakeholders). Responsibilities in destinations may be assigned to multiple stakeholders like businesses, consumers and policymakers. However, the question is still open in terms of whether destinations are responsible for transport emissions. In addition, there is currently limited evidence on climate governance in tourism contexts, specifically not in terms of a measurable decline in absolute emissions (Becken et al., 2020; OECD & UNEP, 2011). In addition, a potential barrier to clearly assigned responsibilities is seen in the form of industry's persistent greenwashing efforts, combined with misleading information provided to customers and missing sustainability targets, particular within the transport sector (Guix, Olle, & Font, 2022; Aurand et al., 2018; Patterson, 2000).

Destinations need to develop strategies to guide tourism on a net zero emission trajectory by 2050 or even earlier. This will require technological innovations, transition policies and changes in consumer behaviour. Given the lack of evidence relating to decarbonisation through tourism industry initiatives, governance will determine the success of mitigation initiatives. Here, our analysis shows that mainly regulatory and market-based policies will contribute to significant emission cuts, albeit voluntary policies are relevant in supporting social norm change (Gössling & Dolnicar, 2022; Gössling & Lyle, 2021). As some policies have a greater potential for emission reductions than others, it will be necessary to prioritise measures on the basis of impact assessments of specific tourism segments. Our findings show that several instruments have already been recommended by various studies, considering, amongst other subjects, the avoid, reduce and substitute hierarchy, albeit with a remaining lack of implementation (Peeters & Eijgelaar, 2014; Peeters & Landre, 2011).

The very extensive approach of this paper also leads to some limitations. Using a combined method for the review, especially in regard of the expert-based approach, leaves room for a subjective and indicative argumentation, due to the complexity of the issue and the profound knowledge of the topic by the authors. However, it allowed evaluations and illustrations that have not been introduced previously in publications, such as a comprehensive overview of tourism-relevant carbon inventory principles, the presentation of options for carbon emission allocation principles, an estimation of mitigation potentials for tourism-specific subsectors or proposals relating to tourism decarbonisation. Correspondingly, the analysis excluded very specific studies of carbon management investigations in tourism, such as scenario studies using methodologies such as National Environmental Kuznets Curves, as this is an exhaustive field of research itself (Sun, Gössling & Zhou, 2022). Other research questions related to the topic also could not be covered in further detail. For example, it would have been very useful to elaborate more on the distribution of responsibilities for emission reductions between different tourism stakeholders and the consequences in terms of formulating common industry-specific goals. Also, barriers to businesses and destinations estimating emissions need further exploration, in particular to provide additional guidance on facilitating comparable calculation methodologies to implement common assessment frameworks. Finally, the paper focused on mitigation, leaving out the necessity for climate adaptation, which comes with further demands and risks, as highlighted in the following paper.

3.3 Paper 3: The challenge of climate change and net zero emissions for destinations

The paper *The challenge of climate change and net zero emissions for destinations* directly picks up on elements and shortcomings from the previous paper and focuses on the specific challenges facing subnational destinations in terms of simultaneously cutting emissions at a radical pace (carbon risk) and preparing for the impacts of climate change (climate risk). The paper provides a conceptual basis for the complex relations between climate and carbon risk for destinations and exemplifies these challenges (but also opportunities) through two case studies.

Methodologically, we conducted desk research and used the results of the systematic literature review from the previous paper, albeit slightly adapting the variables to gain further insights into the relationships between climate mitigation and adaptation. In addition, we used unpublished results from previous fieldworks for the presented case studies, in order to provide additional insights into the topic.

A main result of the paper is a practice-based contextualisation of carbon and climate risks for tourism destinations. Both risks are not equally distributed geographically and will influence supply, demand and competitiveness of destinations at all spatial levels in highly different ways and to varying magnitudes (Scott & Gössling, 2022). Destinations are needed to find solutions that maintain economic returns and employment at a stable level while also supporting concise and effective decarbonisation efforts. Altogether, such approaches are highly interlinked with overall destination resilience (Gössling & Higham, 2020). Measures to be taken in terms of mitigation include encouraging longer stays with constant value added features but with fewer arrivals (Gössling et al., 2018), less air travel by marketing domestic locations and demarketing long-haul markets (Gössling et al., 2015) and reducing leakages by regulating international intermediaries.

We also discuss the variety of different terminologies for mitigation and the related misinterpretation that might follow the use of specific claims such as ‘climate neutrality’.

Destinations are clearly impacted by climate change and, at the same time, destination management has a responsibility to mitigate GHG emissions caused by tourism activities (WTTC, 2021; Ma & Kirilenko, 2020; Scott et al., 2016). Nevertheless, both aspects are most often disproportionate, i.e., even if a destination did reach net-zero, it would not be relieved from negative climate change impacts. This could discourage decision-makers/stakeholders from taking action, as mitigation efforts at the destination level might be perceived as a market disadvantage and responsibility might be demanded to be taken elsewhere. This underlines the foundations of global warming as a common-pool resource problem (Ostrom, 2008). Still, adaptation to changing external developments is not new to destinations, as they continuously adapt to changing demand trends, competitors’ offers, new technologies and legal frameworks (Saarinen, 2004). This calls for an adaptive destination management approach (Hartman, 2023) that also needs to integrate risk management, including climate and carbon risks.

Climate change mitigation and the adaptation of tourism on the subnational level will need to be perceived as part of a holistic destination development that considers individual circumstances regarding natural surroundings, general infrastructure, tourism offers and demand structures. Destinations focusing on either mitigation or adaptation in their destination management plans might be confronted with conflicts of interests or even hampered efforts due limited capacity and resources. Therefore, we recommend integrating both carbon and climate risks into a holistic climate action strategy that takes into account mitigation and adaptation perspectives, integrates different stakeholder needs, including supply chain elements, and provides overall guidance for necessary steps that optimally serve both mitigation and adaptation, or at least minimise conflicting outcomes.

Our practical approach naturally comes with limitations. First and foremost, the paper is targeted at a wider, non-scientific audience with a strong applied focus. Therefore, sections such as the discussion are intentionally kept short, and other parts that have a stronger application base are more detailed. Parts of a wider discourse on most of the findings within the broader academic literature were implemented in the previous paper. Another limitation is that there is not currently a great deal of scientific literature on the net-zero transition challenge for destinations on the subnational level. Thus, we had to focus on a limited number of sources, which in turn might have led to some indicative argumentation. We aimed to minimise this risk by also including a range of non-academic literature as well as specific case studies, to bridge the gap further between scientific approaches and practical implementation.

3.4 Paper 4: Economic impact analysis of tourism in protected areas of the Pomerania region

In the paper *Economic impact analysis of tourism in protected areas of the Pomerania region*, we specify the need to assess economic value creation by tourism in a destination as a main field of sustainability assessments (see Chapter II) and explore two ways of estimating economic impacts in the specific case of protected areas (PA) in Germany and Poland. As existing methodological approaches for economic impact analyses in protected areas are usually very

costly and need advanced scientific expertise, our aim was to adapt existing estimation approaches, with the intention of creating a more affordable and applicable method, especially for structurally weak and peripheral areas such as the Pomerania Euroregion, where no standard method for estimating the economic impact of PA tourism has yet been established.

PAs are ideal study cases for tourism impact assessments, as they are perceived as highly attractive regions for tourists and are often dependent on tourism incomes (Spenceley et al. 2021). At the same time, they are vulnerable areas that are designated for protection and not primarily for visitation (Bushell & Bricker, 2016). The economic valuation of PA tourism has become a prominent field of research, with countries such as the USA and Finland setting up national economic impact monitoring systems (Huhtala et al., 2010) and a range of publications arguing for the implementation of such analyses (Job et al., 2021; Mayer & Stoll-Kleemann, 2016; Pascual et al., 2010; Job, 2008; Flückiger, 2000; Hornback & Eagles, 1999; Rommel, 1998). This is because they provide an argument for the contested valuation of PAs' public goods, they close information gaps and support objectifying debates, they justify the provision of public budgets, their results can be used for self-evaluation and benchmarking internal and external communication, and they contribute to improving the attitudes of local people towards PAs with assumed positive consequences for nature protection outcomes (see also Chapter VI). Overall, economic impact analyses elaborate on the net effects of policies that bring tourism revenues into the PA region that would otherwise not occur, or policies that keep revenues in a PA region that would otherwise be lost. In this way, they are part of the tangible, direct and non-consumptive use values of a PA (Mayer, 2013).

For the empirical study, we applied two different methods. For the German case – the Biosphere Reserve Schorfheide-Chorin – I used the method introduced for biosphere reserves by Job et al. (2013). The aim was to gain a profound understanding of this method and to identify potential adaptations for an optimised methodology applicable to the Pomerania region. Collecting data for estimating visitor numbers and expenditure is crucial to the analysis. In order to determine such data, 7,100 short interviews relating to visitor counts, as well as 1,171 longer face-to-face interviews, were systematically conducted in the Biosphere Reserve at ten predefined locations over a period of 12 months in 2020 and 2021. All surveys were inserted electronically via mobile phones with an app that allowed for them to be conducted offline. A detailed description of the steps for this approach is presented in Chapter V.

For the Polish case – the Wolin National Park – we applied a regionalised input-output (I/O) model based on the classic I/O analysis by Leontief (1936), using cross-industry location quotients for the regionalisation of internationally defined tourism-characteristic industries (Arnegger, 2014; UNSD, 2010). I/O-tables for Poland were derived from the OECD, and average wages for each industry were taken from the Polish National Statistical Office. As the assessment relied on tourism demand data (visitor days and visitor expenditures) to create tourism-specific results, it was necessary to obtain further data from a total of 1,440 face-to-face interviews conducted over 17 separate days during one year (for the visitor expenditure data), and the use of seven automatic visitor counters (for the visitor days) during the same period.

The results of our study showed that both implemented methods have their justifications and that there are quite a few ways of facilitating the approaches. Overall, any estimation of the economic impacts of tourism relies on information about visitor flows and expenditure, as well as regional

multipliers for the included tourism segments. Such data can be obtained through statistically-based visitor counting and surveys throughout the year, which remains a costly exercise, even when the I/O-model is applied. An opportunity to reduce the cost of visitor counting lies in the use of automatic counting devices, which allowed us to obtain data from the Wolin National Park throughout the year, instead of acquiring information for selected days on which visitors were counted, as was the case for the German approach. At the same time, data from automatic counters was used not only for estimating economic impacts, but also for the ongoing monitoring of tourist flows. However, such counters need manual calibration, and data needs to be corrected with a certain factor, as Staab et al. (2021) also highlight. If there are no automatic counters, visitor days can alternatively be estimated empirically by a combination of sampling and secondary data (e.g., overnight statistics from the PA municipalities).

To acquire information about visitor expenditure, we propose using a standardised survey template with a modular structure, which has also been suggested in the literature as a possible solution (Spenceley et al., 2021). Such a survey would be minimal, as the primary objective would be to estimate the structure of expenditure. Additional questions may be clustered into modules and then used on an as-needed basis, which would help reduce costs due to reaching the desired sample size in a shorter time.

Another required element for estimating economic tourism impacts is regional multipliers. As a pilot, we additionally developed a questionnaire to measure value-added ratios and tested it in the Wolin National Park region and the Biosphere Reserve Schorfheide-Chorin (see Appendix VI). The survey in the Polish region included a group of twenty randomly selected enterprises among micro-, small- and medium-sized enterprises. As a result, respondents indicated that the data was too confidential to share, and the vast majority refused to answer the questions. Therefore, the pilot study failed to provide any basis for estimating the value-added ratios. In contrast, in the German Biosphere Reserve, we engaged 120 tourism businesses across all business types within the tourism sector and were able to gain profound knowledge that would be suitable for estimating value-added ratios. We concluded that the regionalised input-output method is the preferred option in the Polish case, as it makes use of widely available national input-output tables to estimate the multiplier effects of PA tourism, instead of using value-added ratios, which are obviously very difficult to obtain for Polish PA regions. As a next step, the regionalised input-output approach could also be applied in the future to additional protected areas in Germany, which would allow for comparing both approaches in more detail and assessing the comparability of these results.

Using such a data-driven and empirical approach, as done in this paper, inherently produces some obstacles. In general, as we experienced in the two cases, there are different perspectives, views and equipment available to conduct such empirical studies within certain protected areas. Thus, implementation of the impact analyses depends highly on the participation and cooperation of a range of stakeholders, including protected area managers, researchers, interviewers, etc. This of course needs a strong coordinative approach with a high degree of professionalism but will always come with minor mistakes and flaws with the research design, especially during data collection and analysis. In addition, the presented approach could not be tested to its full extent, primarily because of the numerous restrictions imposed during the Covid-19 pandemic in 2020 and 2021, which caused a range of necessary alterations, especially for on-site interviews.

Further details are explained in Chapter V. Even though this study led to some important outcomes for approaches to regional economic impacts of PA tourism that can be applied beyond Polish and German PAs, research needs to continue, in order to devise a more affordable approach that still allows internationally comparable results, as proposed in Spencely et al. (2021).

3.5 Paper 5: Analysis of park-people relationships

The final main paper of this thesis, namely *Analysis of park-people relationships* focuses on human interactions in protected areas surroundings. Even though this paper is not directly connected to tourism, it is still indirectly linked to impacts in a subnational context, as tourism is a crucial element of socio-economic development in a PA (Hanley & Barbier, 2009) and can be important in fostering a positive attitude towards PA, especially in regions with high tourism intensity (Mayer and Stoll-Kleemann, 2016). Nevertheless, this paper aimed to provide a more generalist approach, in which tourism is one of a number of influencing factors in people's attitudes to regional development, amongst others (Job et al., 2021).

The aim of this paper is to apply empirically a proposed conceptual framework that tries to understand the behaviour of local people towards protected areas and which is inspired by Ajzen's (2005) theory of planned behaviour, based on the theory of psychological reactance, the theory of social identity, the theory of communication behaviour, the theory of symbolic interaction (Stern, 2008; Schenk et al., 2007; Stoll, 1999) and the explanatory approach of the German Advisory Council on the Environment (SRU, 2002) for a lack of support for nature conservation. The work intends to fill an existing gap, as no general model has yet been developed to explain every interaction between protected areas and the people living in or around them despite a large body of literature talking about park-people relationships (PPR) (Schenk et al., 2007).

For the empirical analysis, we conducted extensive quantitative surveys with inhabitants of fourteen PAs in the German and Polish Pomerania region. This region was chosen because it covers a variety of different PAs in a cross-border rural area and has been characterised by dynamic socio-economic changes in the last few decades that have caused a general population decline and a weaker economy, albeit increasing tourist attractiveness, with some locations being traditional and well-known tourism destinations. The analysis covered the environs of six national parks (three in Poland and three in Germany), seven landscape parks (all of them in Poland) and one biosphere reserve (in Germany). The surveys were conducted using the CATI approach (computer-assisted telephone interviewing, using the random digit dialling method) to achieve a representative sample size in a cost-efficient manner. For every PA, between 385 and 400 completed questionnaires were collected to ensure a high statistical confidence level. In total, our sample consisted of 5,547 cases, and the survey took place between July 2019 and January 2020 and at three parks from September to October 2020. To improve the representativeness of the results, we weighted the data based on location-specific quotas for gender and age. The conception of the questionnaire was inspired by the goal of developing a survey instrument based on existing PPR studies to ensure comparability, which covered the theoretically identified influencing factors of the conceptual framework, namely communication, trust, economic situation, reactance and environmental worldview. For the analysis, we implemented descriptive

statistics and combined the dependent variables of the framework with several independent variables, covering most of the influencing factors on PPR, to showcase their relationships. We mainly used different Likert-type scales, mostly ranging from 1 to 5. As the dataset contained nominal- or ordinal-scaled data, we used Cramer's V association coefficient as a statistical method to distinguish the strength of the association for each value ([0.0; 0.1] – no association, [0.1; 0.3] – weak association, [0.3; 0.6] – moderate association, [0.6; 1.0] – strong association) (Cleff, 2019), followed by p-value significance tests. This allowed us to make statements on the strength and significance of the variable relationships.

The overall results of the empirical study are consistent with comparable studies, such as Job et al. (2019, 2021) or Allendorf (2020). Residents of nearby PAs are mostly in favour of the protected area and do not perceive any constraints associated with living in such a region. Also, attitudes towards PAs become more positive over time, as people get used to the regulations and become more convinced of the positive effects. Again, such developments were confirmed by comparable studies. The results of our PPR studies also underline the relevance of the proposed conceptual framework. It became evident that the variables *communication*, *trust*, *economic viability* and *reactance* are statistically significantly relevant in relation to how interested people are in their protected area and positively influence their personal attitudes to the PA. In contrast, we could not confirm in our cases that the environmental worldview empirically influenced the overall PPR. Also, "economic rationalism" (Stern, 2008), i.e., positive economic effects due to tourism and fostering positive attitudes towards PAs, seems to be less pronounced in the Pomerania region compared to the German Bavarian Forest and Berchtesgaden national parks (Job et al., 2021), given the lower statistical associations of the respective variables in our studies. One potential reason could be the mostly much lower intensity of tourism in large parts of the Pomerania region compared to the two national park regions in south-eastern region of Germany (Job et al., 2013). Furthermore, local people, especially in the Polish part of the Pomerania region, might have been less aware of the economic benefits generated by PA tourism. Still, the analysis confirmed that tourism development in the PA had a positive influence on the overall identification of the population with their environment and that inhabitants support a more qualitative tourism. In contrast to the rather similar level of local people's overall attitudes, we found differing PA awareness between the Polish national and landscape parks. One explanation may be the different protection regimes for landscape parks (more lenient – and thus less noticeable for the local community) and greater restrictions on the use of the protected area in the case of national parks, which affected the level of awareness of their existence. This is underlined by more results provided by Mayer et al. (2019), who analysed awareness of protected area categories in the Polish-German border region and revealed that national parks were better known as a PA category, in comparison to other PAs.

The results are also prone to some limitations. First, we were not able to cover all parts of the conceptual framework in the questionnaire. For instance, the influence of constructs *perceived control* (e.g. participation) and *subjective norm* (e.g. peer group processes) on attitudes towards PAs could not be tested to lacks of the survey. Second, the suitability of the central measure of overall attitudes to PA ("Sunday question") needs to be questioned (see also Job et al., 2021). Due to the very high share of confirmations, it was not possible to implement advanced statistical analyses such as logit regression models to explain influencing factors on this binary overall

attitude variable – even in the case of our PPR studies with more than 5,500 observations. This leads us to a very general constraint, namely that there is no ‘overarching’ acceptance of protected areas (Liebecke et al., 2008, 2011) but rather slightly differing attitudes on several topics, which finally lead (or do not lead) to actions in favour of or against the PA. This implies that ‘acceptance’ analyses, also in the case of tourism, require sophisticated measurement tools, including a range of parameters, to capture the overall attitude of residents on a much more differentiated level.

3.6 Supplementary publications

The publication *Measuring sustainability in tourism – development of a tourism sustainability satellite account* (Appendix I), aimed to create a national indicator system for Germany that would provide an empirical overview of the sustainable development of tourism over time and in relation to the economy as a whole. For this purpose, we identified eighteen sustainability indicators and calculated them, using a combination of German National Accounts and German Environmental-Economic Accounts. The indicator scheme is designed as an expanded tourism satellite account with the addition of ecological and social sustainability indicators. The research project was part of the global initiative Measuring the Sustainability of Tourism (MST), by the World Tourism Organisation, which is developing a general statistical framework for the collection of sustainability-related data on tourism (UNWTO 2017b). The results of this publication were an important baseline and starting point for several conceptual ideas outlined in this thesis, with the aim of applying similar methods on a subnational tourism level, especially regarding climate accounting principles, economic impact analyses and tourism acceptance, elaborated herein as park-people relationships.

The report *Estimating the effects of German outbound tourism on sustainability in visited countries* (Appendix II) emphasises the ‘polluter pays’ principle for sustainability assessments in tourism, by evaluating several related studies from the perspective of the country from where tourism demand originates (outbound tourism). It argues that tourism-related impacts occur not only in destinations, but also, for example, in the case of transportation, during the journey to and from the destination. The results of this report show that this perspective is still widely missing in sustainability assessments. Thus, it was a specific motivation for my further research to include the ‘polluter pays’ principle in the undertaken analyses, especially regarding the environmental impacts of tourism.

The publication *Sustainability in tourism: developments, approaches and clarification of terms* (Appendix III) summarises general principles underpinning the idea of sustainable development in tourism. In essence, it highlights substantive aspects and developments in the sustainability debate and explains how these can be used to define sustainability in tourism. The study aims to help clarify the term ‘sustainability in tourism’ in the German-speaking context, in order to foster consensus regarding German tourism policy. Several aspects of the report supported my desire to implement in-depth reviews about sustainability assessments and the principles of carbon management in tourism.

The practical report *On the way to climate neutrality in tourism destinations. Guide to climate accounting in tourism* (Appendix IV) presents specific cases for a comprehensive assessment of

tourism-specific GHG emissions, by applying both bottom-up and top-down climate accounting approaches for subnational tourism destinations. It describes the specific approaches taken for both methods and presents outcomes of tourism-specific GHG assessments for the city of Berlin, the province of Mecklenburg Western Pomerania and the local Northern Black Forest. The report is a practical continuation of the work presented here in Chapters III and IV and represents a first pilot study for applying GHG accounting methods for German tourism destinations.

The paper *Is sustainable tourism rising as a phoenix from the crisis?* (Appendix V) was a first reflection on the impacts of Covid-19 on tourism development. It argues that setting up strong cooperation models and sustainability-based strategies will offer opportunities for tourism innovations in the long run. Based on expert interviews, the paper concludes that tourism activities will have to meet new requirements in terms of hygiene, health and safety, which arise from the corona situation and are perceived by guests as a new basic quality. These new qualities will be linked to criteria associated with environmentally friendly business practices, regional identity and social responsibility. The paper provided me with some general guidance on the further research implications of this thesis, especially depicting the three main parameters carbon management, local economic values and tourism acceptance as examples of new tourism 'qualities'.

The publication *Effects of Covid-19 on visitation and tourism in the protected areas of the Pomerania region* (Appendix VI) includes research that is directly related to Chapters V and VI, as it empirically presents the effects of the coronavirus pandemic on tourism in selected PAs in the Pomerania region, covering the perspectives of residents (directly related to Chapter VI), the demand side (directly related to Chapter V) and the tourism industry itself. The study was an important complement for the overall empirical research undertaken in the Pomerania region, thereby providing further insights especially for PA management.

4. Synthesis

This last section of the framework paper synthesises insights and findings from my presented research by focusing on theoretical, methodological and practical contributions and offers a general critical reflection.

4.1 Theoretical contributions

This research contributes to the existing literature by exploring specific elements of tourism development that are currently challenging related models. It focuses on the advancement of monitoring and measurement approaches to improve destination sustainability performance with the support of sustainability assessments in tourism (SAT). From the literature, we found that the development of SAT has increased tremendously in the last decades (Vukadin, Zovko & Kresic, 2020; Rasoolimanesh et al., 2020; Asmelash & Kumar, 2019), in turn also creating unrealistic expectations in terms of sustainable tourism indicators leading to change (Font et al., 2021). In addition, authors claim that indicator schemes are not yet playing an instrumental and structural role in political decision-making (Crabolu et al., 2023; Miller & Torres-Delgado, 2023), the reasons for which are manifold, with some scholars demanding a more thorough systems

perspective (Kristjánsdóttir et al., 2017; Mai & Smith, 2015; Schianetz & Kavanagh, 2008) and others focusing on influencing factors for their non-use in decision-making (Bauler, 2012; Bell and Morse, 2011). Our systematic review showcased that there is a need to contextualise sustainability assessments and that the focus should be on advancing core issues that are of generally high global relevance and trigger sustainable tourism development, rather than intending to develop a standardised and most-suitable set of indicators for all destinations. This is not in conflict with current approaches that intend to embed SAT in complexity science, thus providing important insights into influencing factors that create stakeholder buy-in, active engagement and lead to policy changes for destination management (Crabolu, 2021; Font et al. 2021). My research rather complements such efforts by showcasing concrete use cases that mainly focus on the implementation of specific quantification approaches, in terms of conceptual backgrounds, methodological implications and measurability necessities. This also refers to the idea that indicators serve a political purpose, with the aim of choosing politically desired evidence to justify certain decisions (Gudmundsson & Sørensen, 2013; Hezri & Dovers, 2006). In the case of carbon accounting and economic impact analyses, it became evident that there is a range of possible accounting principles influencing the results, even though the amount of 'carbon emissions' will be perceived as one particular indicator. Therefore, it is necessary to explore different approaches in detail and to evaluate possible variations in outcomes, as we exemplify in Chapters III, V and VI.

Decision-making in complex systems such as tourism relies on information based on certain levels of agreement and certainty (Stacey, 2010; Head, 2010). A purely technical decision-making process, where data can be directly used to predict actions for the future, is almost unachievable in systems like tourism, which are often characterised by uncertainty, messiness and controversial ideologies (Head, 2015). Decisions for destination management are often confronted with low levels of agreement for certain actions, even though evidence is clear (for example, the choice of strategies in cases of low tourism acceptance), or they are unclear in terms of actual evidence, even though there is a high level of agreement (for example, reducing the impacts of tourism on the natural environment, without having empirical evidence on tourism effects). This is why current research uses complexity theory and design principles to support a more practical and applied approach to systems-based decision-making (Geyer and Cairney, 2015; Nijs, 2014; Cairney, 2012; Eppel & Rhodes 2017;). For sustainability assessments in tourism, aspects of complexity should be embraced by focusing on specific issues that foster different sustainability elements as the main drivers for change and encourage management or policymakers to take decisions that affect multiple sustainability issues. Different examples are provided in Chapters III, IV, V and VI. For example, in the case of carbon management, integrated climate action strategies will need to include measures that cut emissions drastically, including a shift towards more regionalised value chains that might provide alternative income possibilities for several tourism stakeholders and strengthen local economies. Thus, a significant part of this research attempts to investigate the potential variables (specifically climate management, economic value creation and local sentiments towards regional development) that act as enabling conditions for a wider implementation of sustainability strategies in destinations.

4.2 Methodological contributions

This research makes several methodological contributions to evaluating the environmental and socio-economic impacts of tourism. First, it addresses methodological considerations of sustainability assessments in tourism from a meta perspective by reviewing different concepts and accounting principles and applying them to different scales of tourism concepts. Thus, we attempt to integrate our considerations into wider conceptual and application-based spectrums, by providing different options for assessment contexts and including additional projections such as emission reduction potentials with the help of existing estimates, for example in our papers in Chapters III and IV. As such, this research contributes to work about recent critical evaluations of sustainability assessment methods by scholars such as Font et al. (2021), Rasoolimanesh et al. (2020), Asmelash & Kumar (2019) and Kristjánsdóttir et al. (2017), as well as contributions about climate accounting approaches in tourism by Sun & Higham (2021), Scott & Gössling (2022), Becken (2019), amongst others.

Additionally, we put several conceptual frameworks about trajectories for developing sustainable destination economies and tourism policy paradigms into context, such as the different orders of change by Hall (2011), the concept of the destination tripartite by Gössling & Higham (2020) or the explanatory model for attitudes and behaviours of local people in relation to protected areas by Mayer & Stoll-Kleemann (2016). In these cases, we attempt to clarify their ideas by depicting specific parameters, reviewing them in detail and then applying them to concrete cases in selected regions.

Furthermore, we apply modern and complex data collection and analysis methods with a focus on quantitative data collection methodologies, as presented in Chapters V and VI, as well as in Appendix VI. In particular, we demonstrate in the case of tourism impact analyses in protected areas, that data collection may be facilitated by applying I/O-models in combination with interviews. Also, we experimented on ways of making economic impact assessments more cost-efficient and practical, as proposed in Spencely et al. (2021). The outcomes and learnings herein can support other scholars when setting up similar assessment approaches. With regard to park-people relationships, we were able to generate a remarkable sample-size for a peripheral, cross-border region by applying CATI and thus elaborated on a range of potentials of and barriers to this method for data analysis and the robustness of results. Overall, this may open up opportunities for other researchers seeking to identify causalities when investigating residents' sentiments towards tourism development through quantitative approaches.

4.3 Practice contributions

A substantial ambition of my research was to contribute to current practices of tourism governance and SAT applications. The recent development and implementation of tourism sustainability indicator schemes for decision-making has received a lot of attention from international and national tourism institutions. They strive to create standardised approaches for sustainable tourism monitoring, with the aim of creating consistency in methodologies and comparability between destinations. Examples are the UNWTO initiative 'Measuring Sustainability of Tourism' (UNWTO, 2017b) and the International Network of Tourism Observatories (UNWTO, 2022), several national OECD projects on tourism indicator schemes

(OECD, 2022), funded by the EU Commission or the recently published EU Tourism Dashboard by Eurostat (2023). There is a clear tendency to establish ambitious sets of sustainability indicators as comparable information systems for tourism decision-making. Most of them, however, lack specific methodological approaches, remain on the national scale or have a tendency towards simplified and reductionist parameters without being tourism-specific. As shown in this research, such 'indicator lists' fall short in their applicability on the subnational destination level and may result in a missing practical implementation. As in the case of carbon accounting, a recent review study by the UNWTO (2023) on methodologies and tools for measuring GHG emissions concluded that destinations rarely have tools or support instruments when seeking to measure emissions. Similar situations apply to estimating the economic impacts of tourism and tourism acceptance on the regional or local level. Thus, this research provides some clarifications about certain measurement methodologies and could thus enhance ongoing debates about specific issues. As briefly presented in Appendix IV, some recommended approaches for carbon accounting have already been developed further by us, published as a practical guide and applied in several German tourism destinations, mainly implementing the recommendations made by Chapters III and IV.

The thesis also supports participatory processes, stakeholder buy-in and the active engagement of tourism stakeholders in destinations. Part of the empirical research presented in Chapters V and VI involved the implementation of dozens of scientific planning meetings, conceptual workshops with local tourism stakeholders and dissemination events for a wider interested audience. The results for Chapters II and III were also presented at several regional, national and international tourism events, partly as a result of invitations received from tourism policy institutions such as ministries, tourism associations or international bodies such as the UNWTO. This ensured the overall practical relevance of each of the presented chapters and will hopefully generate further significant impacts for the industry.

4.4 General critical reflection

In addition to the already presented individual chapters, the thesis was confronted with some general constraints and research gaps at both the methodological and the conceptual level while conducting the research. A main limitation relates to the coronavirus pandemic during the research period, which resulted in adapting the overall research and influenced the coherence of parts of the thesis. Thus, I decided to place stronger emphasis on conceptual elements of the thesis and elaborated more on specific topics such as climate management. In addition, we included Covid-19 effects on tourism in our empirical research, in order to gain more knowledge on actual impacts for destinations. However, due to the various lockdown periods and social distancing regulations, we also had to adapt parts of the empirical research, focusing more on offsite methodologies such as CATI and stopping personal interviews. Furthermore, a business survey we conducted, which aimed to provide more information about the environmental and social sustainability aspects of tourism businesses, with the intention of combining environmental and economic sustainability impacts, did not deliver satisfactory results, which meant it was not considered herein.

Another constraint (and strength) of the thesis is the choice of specific sustainability issues as conceptual and empirical cases. There might be the impression of arbitrary selection and that any other indicators could fulfil the same purpose of being chosen as focal points. This notion is countered with recent literature such as by Gössling & Higham (2021), Scott, Hall, & Gössling (2019), Sharpley & Telfer (2015) and Schilcher (2007), all of whom point to the pressing need for tourism destinations to explicitly provide solutions for low-carbon tourism, maintaining local incomes and employment benefits as well as assuring positive community sentiments towards tourism – all of which are the main drivers of future destination management. In addition, these aspects cover important topics in relation to the main sustainability dimensions and therefore reflect specific sustainability issues. Finally, choosing these issues meant that it was possible to explore them in great detail and to empirically experiment on different assessment approaches, which would not have been possible otherwise.

Finally, as outlined at the beginning of this chapter, the thesis takes a rather pragmatic and application-based perspective, referring as it does to several theoretical concepts and frameworks. This comes with a certain degree of difficulty in terms of clinging on to a single theory as an overarching topic, other than the general concepts of transition, systems understanding and resource economics. Backed up by these general ideas, the thesis deliberately provides specific solutions of evidence-based information for destination managers, to help them cope with existing transformative challenges.

5. Conclusion

This thesis is part of recent efforts to establish profound and effective measurement approaches for sustainable tourism. It highlights that concrete assessment tools are needed for evidence-based decision-making and the establishment of effective actions in destination management. Sustainability assessments need to be better contextualised, and unrealistic expectations of constructing ideal schemes will need to be adapted. The thesis supports the idea that assessments should focus on specific issues that foster different sustainability elements as the main drivers of change and encourage management or policymakers to take decisions that affect multiple sustainability issues. It also addresses methodological considerations of sustainability assessments in tourism from a meta perspective by reviewing different concepts and accounting principles. In addition, it looks at conceptual frameworks about developing sustainable destination economies with a specific emphasis on carbon accounting, economic value creation and local sentiments. The thesis empirically evaluates and applies these issues in specific cases, with the help of quantitative data collection methodologies. Overall, the research provides clarification about certain measurement methodologies and will enhance ongoing debates about the sustainability impacts of tourism. Thus, the findings of this research are of value to tourism managers and international organisations involved in designing, promoting and implementing sustainability assessments.

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Chapter II

Characterising and identifying gaps in sustainability assessments of tourism - a review.

Balas, M., Abson, D. (2022). Characterising and identifying gaps in sustainability assessments of tourism - a review. *Tourism Management Perspectives*. 43, 101004
<https://doi.org/10.1016/j.tmp.2022.101004>

Due to legal requirements, this article is not published in this dissertation and has to be obtained directly from the publisher.

Chapter III

A review of tourism and climate change mitigation: The scales, scopes, stakeholders and strategies of carbon management

Chapter IV

The challenge of climate change and net zero emissions for destinations.

Balas, M., Mayer, M. The challenge of climate change and net zero emissions for destinations. In Pillmayer, M., Hansen, M., Karl, M. Tourism destination development: A geographic perspective on destination management and tourist demand. De Gruyter Tourism Studies.

Due to legal requirements, this chapter is not published in this dissertation and has to be obtained directly from the publisher.

Chapter V

Economic impact analysis of tourism in protected areas of the Pomerania region.

Chapter VI

Analysis of park-people relationships

Appendix I

Balas, M., Strasdas, W., Neumann, F., Mattes, A., Becker, L., Giese, J, Renner, A., Weber, A., Kohl, K., Pinnow, D., Zeiner, M., Rein, H. & Heck, S. (2021). Messung der Nachhaltigkeit im Tourismus - Entwicklung eines Tourismus-Nachhaltigkeits-Satellitenkontos. (Measuring sustainability in tourism - development of a tourism sustainability satellite account). German Environment Agency.

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Summary

The aim of the project was to develop a practicable system for measuring sustainability of national tourism in Germany. Initially, 18 sustainability criteria for tourism were identified. In a second step, these criteria were analyzed with regard to their measurability using indicators in a coherent accounting system in compliance with international recommendations. The outcome is a Tourism Sustainability Satellite Account (TSSA), a system of indicators which is mainly based on statistical frameworks of national accounts and environmental-economic accounts. In addition, social indicators have been added that mainly measure decent job creation in tourism. Thus, the TSSA allows a systematic allocation of the economic, ecological and social impacts of tourism to the tourism-relevant economic sectors at a national level. However, there is still a need for development of some sustainability indicators, especially from the management and, to some extent, the ecological sector. As a test, the TSSA indicators have been filled with currently available data. The results show that tourism in Germany contributes significantly to creating added value and jobs, although labor productivity is low. In terms of ecological impacts, climate impacts with a slightly above average greenhouse gas intensity compared to the economy as a whole are at the top of the list, although this intensity varies significantly within the tourism sub-sectors. Working conditions are generally considered to be less sustainable than in other industries. Only the pay gap between men and women is significantly smaller than in other sectors of the economy.

Appendix II

Balas, M. & Strasdas, W. (2020): Erfassung von Auswirkungen des deutschen Outbound-Tourismus auf die Nachhaltigkeit in bereisten Ländern. (Estimating the effects of German outbound tourism on sustainability in visited countries.). German Environment Agency. https://www.umweltbundesamt.de/sites/default/files/medien/5750/publikationen/2020_12_09_tex-te_232-2020_themenpapier_outbound-tourismus.pdf (Accessed: 13th September 2023)

Summary

Sustainability assessments in tourism mainly focus on incoming tourism, be it from a destination-specific perspective or a production-based perspective. The "polluter pays" approach, which is widespread in the sustainability debate, is often not considered, neither in the concepts of the UN World Tourism Organization nor in national indicator systems for sustainable tourism. Thus, the ecological, socio-economic and socio-cultural impacts generated by tourism-related consumption by German residents abroad are not recorded by now. This paper introduces several studies and frameworks for sustainability impacts of outbound tourism. None of the studies considered in this paper allow an overall assessment of the sustainability impacts. There is either a focus on specific groups of countries, or individual sustainability aspects such as ecological factors are being analysed. It is obvious that the social dimension of sustainability is insufficiently, if at all, included in the analysed studies. Furthermore, it is apparent that various methodological approaches are used that do not allow for a comparison of data from different studies or even the combination of different sustainability aspects from the respective studies. As there is no standardised methodology for the assessment of data-based sustainability impacts of tourism, it is recommended to consider outbound tourism in future studies and analyses. There is an urgent need for further research on data generation methods.

Appendix III

Balas, M., Strasdas, W. (2019). Sustainability in tourism: developments, approaches and clarification of terms. German Environment Agency.

<https://www.umweltbundesamt.de/publikationen/sustainability-in-tourism-developments-approaches> (Accessed: 13th September 2023)

Summary

Sustainability is understood as an ethically motivated guiding principle for future-oriented social development, which is constantly subject to trade-offs between different interests. In this process, tourism is seen both as an ally of sustainable development and as a cause of undesired ecological and socio-cultural effects. First applied to tourism in connection with a number of alternative niche markets, an integrated view of sustainability relating to the entire tourism industry has since emerged. Nevertheless, the multi-faceted interactions with a range of social and economic processes has precluded the formulation of a tourism-specific definition of sustainability. For this reason, the authors advocate the term "sustainability in tourism", which describes tourism as a component of a wider sustainable development. This interpretation permits a systemic approach within which different, mutually influencing economic sectors and levels of action interact and under which all principles of sustainability can be classified.

Appendix IV

Balas, M., Mayer, M., & Kintscher, C. (2023). Auf dem Weg zur Klimaneutralität in Tourismusdestinationen. Leitfaden zu Klimabilanzierungen im Tourismus. (On the way to climate neutrality in tourism destinations. Guide to climate accounting in tourism.). Eberswalde/München: reCET/Hochschule München. https://kompetenzzentrum-tourismus.de/media/lift_klima_klimabilanzierungen_im_tourismus_leitfaden_final.pdf (Accessed: 13th September 2023)

Summary

Decarbonising tourism is a critical element of future-proofing the sector. The first step in achieving this is to systematically measure the carbon footprint and to Understand the greenhouse gas emissions profile of a tourism destination. This report introduces two main methodological approaches to measure GHG emissions for subnational tourism destinations. The bottom-up approach uses tourist activity data in a destination and links these with emission factors. Thus, data on visitor behaviour are combined with average emissions per type of activity. From this, detailed data per tourism segment or visitor groups can be presented. The top-down method is a macro-economic approach and records emissions by economic sector using extended environmental-economic accounts. This allows emission linkages of the sector and all emission types to be mapped. This calculation also allows a differentiated view of emission sources and the identification of emission-intensive or low-emission subsectors. The report exemplifies the calculation of emissions in the destinations Mecklenburg-Western Pomerania, Berlin and Northern Black Forest according to the two approaches "bottom-up" and "top-down". As a result, the report provides orientation for other destinations that seek to measure their GHG emissions.

Appendix V

Balas, M., Lund-Durlacher, D., Strasdas., W. (2020): Steigt Nachhaltiger Tourismus als Phönix aus der Krise? (Is sustainable tourism rising as a phoenix from the crisis?) In Tourismus Wissen – quarterly, 21(6), 195-200.

Summary

The Corona crisis was an unprecedented challenge for tourism professionals in the years 2020 until 2022. Long-established and successful practices of the tourism industry came to a standstill. A rapid recovery to the old business logic was less and less foreseeable and the longstanding goal of further volume growth in the industry was thwarted by containment measures of the virus, at least in the medium term. This article provided a reflection of the first months after the Covid outbreak, summarizing results of various expert interviews with tourism professionals. It highlights that strong cooperation models and sustainability-based orientations at all levels are more in demand than ever before, because they offer opportunities for innovation, give rise to new jointly developed products and are a sign of the industry's own responsibility, securing its current existence. The article concludes that tourism services will have to meet new requirements in terms of hygiene, health and safety that arise from the corona situation and are perceived by guests as a new basic quality. However, these new qualities are not only of a hygienic, health and safety nature, but are also linked to criteria of environmental friendliness, regionality and social responsibility.

Appendix VI

Balas, M., Majewska, A. (2022). Effects of COVID-19 on visitation and tourism in the protected areas of the Pomerania region. In: Zbaraszewski, W., Balas, M., Dmytrów, K., Majewska, A., Mayer, M., Steingrube, W. (2022). Socio-economic research in protected areas of the Euroregion Pomerania: Visitor satisfaction, economic impacts and park–people relationships. Poznań: Bogucki Wydawnictwo Naukowe.

<https://doi.org/10.12657/9788379864201>

Summary

This article provided an in-depth analysis of the effects of COVID-19 on tourism in the protected areas (PA) of the Pomerania Euroregion. It is based on three major surveys covering the perspective of inhabitants of 14 PA (5,600 responses), tourists in five PA (2,770 responses) and 120 tourism businesses in one PA. The visitor surveys showed that many visitors chose one of the PAs as an alternative destination to their originally planned journey, which created new economic potentials for the tourism businesses, as the visitors who were affected by the coronavirus spent more money in the region and stayed there longer. This resulted in even higher tourism incomes for the analysed Schorfheide-Chorin Biosphere Reserve, compared to 2017/18 when a similar economic impact study was conducted. Even though the overall economic situation of tourism in Schorfheide-Chorin Biosphere Reserve did not decrease due to the pandemic, our business-survey showed that this did not account for all tourism businesses in the region, as COVID-19 created both winners and losers in terms of economic performance in the years of the pandemic. Hence, business outlooks are rather pessimistic, as the pandemic is still ongoing. Surveys conducted in the Polish PAs in September and October 2020 showed that the respondents, despite declaring a high level of knowledge about coronavirus, in many cases took a neutral stance. It can be assumed that a future regulated and evidence-based approach to pandemics will also stabilise tourism in PAs again and that the current potentials for developing sustainable tourism approaches can be used to further pursue conservation interests and to increase the quality of life of the host population by way of tourism activities.